

## รายการอ้างอิง

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สถาบันวิทยบริการ  
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ภาคผนวก

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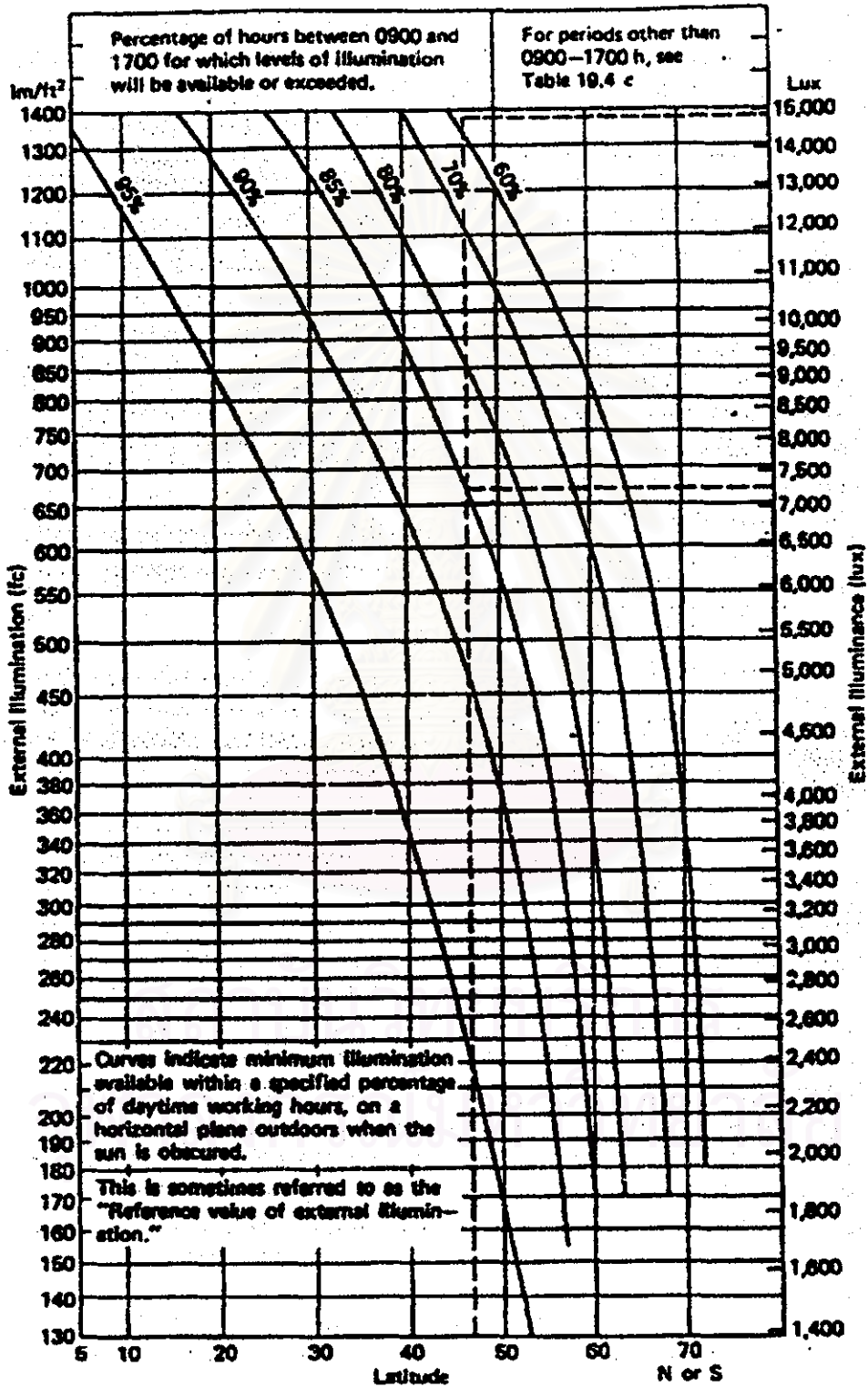
ภาคผนวก ก. ตารางแสดงตำแหน่งของดวงอาทิตย์ มุมโพรไฟล์ (Profile Angle) มุม (Azimuth Angle)

วันที่ 21 ของทุกเดือน ณ เวลาต่าง ๆ สำหรับเส้นรุ้งที่ 14 องศาเหนือ  
(ที่มา : เทคนิคการออกแบบบ้านประหยัดพลังงาน เพื่อชีวิตที่ดีกว่า , หน้า 240)

| Month     | Solar Time |     | Profile (Shadow Line) Angle |     |    |     |    |     |    |     |    |     |    |     |    |     | Solar Position |     | Solar Time |     |     |      |    |
|-----------|------------|-----|-----------------------------|-----|----|-----|----|-----|----|-----|----|-----|----|-----|----|-----|----------------|-----|------------|-----|-----|------|----|
|           | Time       | ALT | N                           | NNE | NE | ENE | E  | ESE | SE | SSE | S  | SSW | SW | WSW | W  | WNW | NW             | NNW | HOR        | AZ  | ALT | Time |    |
| DEC       | 7          | 8   | 63                          |     |    | 23  | 11 | 9   | 8  | 8   | 10 | 17  | 82 |     |    |     |                |     | 82         | 83  | 8   | 7    |    |
|           | 8          | 20  | 68                          |     |    | 59  | 33 | 24  | 21 | 21  | 25 | 35  | 88 |     |    |     |                |     | 70         | 58  | 20  | 8    |    |
|           | 9          | 32  | 60                          |     |    | 82  | 64 | 36  | 33 | 32  | 36 | 44  | 84 |     |    |     |                |     | 58         | 50  | 32  | 9    |    |
|           | 10         | 43  | 38                          |     |    |     | 74 | 58  | 46 | 43  | 44 | 46  | 82 | 83  |    |     |                |     | 48         | 38  | 43  | 10   |    |
|           | 11         | 50  | 22                          |     |    |     |    | 73  | 59 | 53  | 50 | 52  | 59 | 72  |    |     |                |     | 40         | 22  | 50  | 11   |    |
|           | 12         | 53  | 0                           |     |    |     |    | 90  | 74 | 82  | 55 | 53  | 55 | 82  |    |     |                |     | 37         | 0   | 53  | 12   |    |
|           | 13         | 50  | 22                          |     |    |     |    |     |    |     | 82 | 50  | 53 | 59  | 73 |     |                |     | 40         | 22  | 50  | 13   |    |
|           | 14         | 43  | 38                          |     |    |     |    |     |    |     | 49 | 44  | 43 | 48  | 56 | 74  |                |     | 48         | 38  | 43  | 14   |    |
|           | 15         | 32  | 50                          |     |    |     |    |     |    |     | 44 | 36  | 32 | 33  | 39 | 54  | 82             |     | 58         | 50  | 32  | 15   |    |
|           | 16         | 20  | 68                          |     |    |     |    |     |    |     | 35 | 25  | 21 | 21  | 24 | 33  | 59             |     | 70         | 58  | 20  | 16   |    |
|           | 17         | 8   | 63                          |     |    |     |    |     |    |     | 17 | 10  | 8  | 8   | 9  | 11  | 23             |     | 82         | 63  | 8   | 17   |    |
|           | JAN + NOV  | 7   | 9                           | 67  |    |     | 23 | 12  | 10 | 9   | 10 | 12  | 21 |     |    |     |                |     |            | 81  | 67  | 9    | 7  |
|           |            | 8   | 22                          | 62  |    |     | 55 | 33  | 25 | 22  | 23 | 27  | 40 | 75  |    |     |                |     |            | 68  | 62  | 22   | 8  |
|           |            | 9   | 34                          | 53  |    |     | 78 | 63  | 40 | 35  | 34 | 39  | 49 | 70  |    |     |                |     |            | 58  | 53  | 34   | 9  |
|           |            | 10  | 45                          | 42  |    |     |    | 72  | 67 | 49  | 45 | 47  | 53 | 66  |    |     |                |     |            | 48  | 42  | 45   | 10 |
|           |            | 11  | 53                          | 24  |    |     |    | 89  | 73 | 61  | 55 | 53  | 55 | 62  | 62 |     |                |     |            | 37  | 24  | 53   | 11 |
|           |            | 12  | 56                          | 0   |    |     |    |     | 90 | 75  | 65 | 58  | 55 | 58  | 75 | 75  |                |     |            | 34  | 0   | 56   | 12 |
| 13        |            | 53  | 24                          |     |    |     |    |     |    |     | 55 | 53  | 55 | 61  | 73 | 59  |                |     | 37         | 24  | 53  | 13   |    |
| 14        |            | 45  | 42                          |     |    |     |    |     |    |     | 53 | 47  | 45 | 48  | 57 | 72  |                |     | 46         | 42  | 45  | 14   |    |
| 15        |            | 34  | 63                          |     |    |     |    |     |    |     | 49 | 39  | 34 | 35  | 40 | 53  | 78             |     | 56         | 53  | 34  | 15   |    |
| 16        |            | 22  | 62                          |     |    |     |    |     |    |     | 40 | 27  | 23 | 22  | 25 | 33  | 55             |     | 68         | 62  | 22  | 16   |    |
| 17        |            | 9   | 67                          |     |    |     |    |     |    |     | 21 | 12  | 10 | 9   | 10 | 12  | 23             |     | 61         | 67  | 9   | 17   |    |
| FEB + OCT |            | 7   | 12                          | 76  |    |     | 55 | 22  | 15 | 12  | 12 | 14  | 19 | 40  |    |     |                |     |            | 79  | 76  | 12   | 7  |
|           |            | 8   | 26                          | 71  |    |     | 84 | 48  | 33 | 27  | 28 | 28  | 35 | 55  |    |     |                |     |            | 65  | 71  | 26   | 8  |
|           |            | 9   | 38                          | 64  |    |     |    | 69  | 51 | 43  | 39 | 40  | 47 | 61  |    |     |                |     |            | 51  | 64  | 39   | 9  |
|           |            | 10  | 51                          | 52  |    |     |    | 85  | 69 | 59  | 52 | 61  | 58 | 64  | 78 |     |                |     |            | 39  | 52  | 51   | 10 |
|           |            | 11  | 61                          | 32  |    |     |    |     | 85 | 74  | 68 | 62  | 62 | 65  | 72 | 72  |                |     |            | 29  | 32  | 61   | 11 |
|           |            | 12  | 65                          | 0   |    |     |    |     | 90 | 80  | 72 | 67  | 65 | 65  | 67 | 80  |                |     |            | 25  | 0   | 65   | 12 |
|           | 13         | 61  | 32                          |     |    |     |    |     |    |     | 65 | 62  | 62 | 66  | 74 | 85  |                |     | 29         | 32  | 61  | 13   |    |
|           | 14         | 51  | 62                          |     |    |     |    |     |    |     | 64 | 55  | 51 | 59  | 69 | 69  | 85             |     | 39         | 32  | 51  | 14   |    |
|           | 15         | 39  | 64                          |     |    |     |    |     |    |     | 61 | 47  | 40 | 39  | 43 | 51  | 69             |     | 51         | 64  | 39  | 15   |    |
|           | 16         | 26  | 71                          |     |    |     |    |     |    |     | 55 | 35  | 28 | 26  | 27 | 33  | 48             | 84  | 65         | 71  | 26  | 16   |    |
|           | 17         | 12  | 76                          |     |    |     |    |     |    |     | 40 | 19  | 14 | 12  | 12 | 15  | 22             | 56  | 79         | 76  | 12  | 17   |    |
|           | MAR + SEP  | 7   | 14                          | 87  |    |     | 39 | 21  | 18 | 14  | 15 | 19  | 31 | 76  |    |     |                |     |            | 76  | 87  | 14   | 7  |
|           |            | 8   | 28                          | 82  |    |     | 66 | 43  | 33 | 29  | 30 | 35  | 47 | 76  |    |     |                |     |            | 61  | 82  | 28   | 8  |
|           |            | 9   | 43                          | 77  |    |     | 81 | 61  | 50 | 44  | 44 | 48  | 58 | 76  |    |     |                |     |            | 47  | 77  | 43   | 9  |
|           |            | 10  | 57                          | 67  |    |     |    | 76  | 66 | 59  | 57 | 59  | 68 | 76  |    |     |                |     |            | 33  | 67  | 57   | 10 |
|           |            | 11  | 69                          | 49  |    |     |    | 81  | 74 | 71  | 70 | 72  | 76 | 83  |    |     |                |     |            | 21  | 49  | 69   | 11 |
|           |            | 12  | 76                          | 0   |    |     |    |     | 90 | 85  | 80 | 77  | 76 | 77  | 80 | 85  |                |     |            | 14  | 0   | 76   | 12 |
| 13        |            | 69  | 49                          |     |    |     |    |     |    |     | 76 | 72  | 70 | 71  | 74 | 81  |                |     | 21         | 49  | 69  | 13   |    |
| 14        |            | 57  | 67                          |     |    |     |    |     |    |     | 76 | 66  | 59 | 57  | 58 | 66  | 76             |     | 33         | 67  | 57  | 14   |    |
| 15        |            | 43  | 77                          |     |    |     |    |     |    |     | 76 | 59  | 48 | 44  | 43 | 50  | 61             | 81  | 47         | 77  | 43  | 15   |    |
| 16        |            | 29  | 82                          |     |    |     |    |     |    |     | 76 | 47  | 35 | 30  | 29 | 33  | 43             | 66  | 61         | 82  | 29  | 16   |    |
| 17        |            | 14  | 87                          |     |    |     |    |     |    |     | 76 | 31  | 19 | 15  | 14 | 18  | 21             | 39  | 76         | 87  | 14  | 17   |    |
| APR + AUG |            | 6   | 3                           | 101 | 14 | 5   | 4  | 3   | 3  | 4   | 5  | 14  |    |     |    |     |                |     |            | 87  | 101 | 3    | 6  |
|           |            | 7   | 17                          | 88  | 69 | 31  | 22 | 18  | 18 | 20  | 27 | 61  |    |     |    |     |                |     |            | 73  | 88  | 17   | 7  |
|           |            | 8   | 32                          | 95  | 82 | 53  | 39 | 33  | 32 | 35  | 44 | 64  |    |     |    |     |                |     |            | 58  | 95  | 32   | 8  |
|           |            | 9   | 46                          | 82  | 88 | 68  | 55 | 48  | 46 | 49  | 57 | 72  |    |     |    |     |                |     |            | 44  | 82  | 46   | 9  |
|           |            | 10  | 61                          | 69  |    |     | 78 | 69  | 63 | 61  | 63 | 68  | 78 |     |    |     |                |     |            | 29  | 69  | 61   | 10 |
|           |            | 11  | 75                          | 63  |    |     | 85 | 61  | 77 | 75  | 78 | 83  |    |     |    |     |                |     |            | 15  | 63  | 75   | 11 |
|           | 12         | 88  | 0                           |     |    |     |    | 90  | 86 | 85  | 85 | 85  | 85 | 86  | 90 |     |                |     | 4          | 0   | 88  | 12   |    |
|           | 13         | 75  | 83                          |     |    |     |    |     |    |     | 83 | 76  | 76 | 75  | 77 | 81  | 86             |     | 15         | 83  | 75  | 13   |    |
|           | 14         | 61  | 89                          |     |    |     |    |     |    |     | 78 | 68  | 63 | 61  | 63 | 69  | 78             |     | 29         | 89  | 61  | 14   |    |
|           | 15         | 46  | 92                          |     |    | 88  |    |     |    |     | 72 | 57  | 49 | 46  | 46 | 55  | 66             |     | 44         | 92  | 46  | 15   |    |
|           | 16         | 32  | 95                          |     |    | 82  |    |     |    |     | 64 | 44  | 35 | 32  | 33 | 39  | 53             |     | 58         | 95  | 32  | 16   |    |
|           | 17         | 17  | 98                          |     |    | 68  |    |     |    |     | 51 | 27  | 20 | 18  | 18 | 22  | 31             |     | 73         | 98  | 17  | 17   |    |
|           | 18         | 3   | 101                         | 14  |    |     |    |     |    |     | 14 | 5   | 4  | 3   | 3  | 4   | 5              |     | 87         | 101 | 3   | 18   |    |
|           | APR + AUG  | 6   | 5                           | 109 | 14 | 7   | 5  | 5   | 5  | 6   | 11 | 66  |    |     |    |     |                |     |            | 86  | 109 | 5    | 6  |
|           |            | 7   | 19                          | 197 | 49 | 29  | 21 | 19  | 20 | 24  | 32 | 79  |    |     |    |     |                |     |            | 72  | 197 | 19   | 7  |
|           |            | 8   | 33                          | 105 | 68 | 47  | 36 | 33  | 34 | 39  | 52 | 79  |    |     |    |     |                |     |            | 58  | 105 | 33   | 8  |
|           |            | 9   | 47                          | 104 | 77 | 61  | 51 | 47  | 48 | 53  | 64 | 83  |    |     |    |     |                |     |            | 44  | 104 | 47   | 9  |
| 10        |            | 61  | 106                         | 81  | 71 | 64  | 61 | 62  | 67 | 75  |    |     |    |     |    |     |                |     | 30         | 106 | 61  | 10   |    |
| 11        |            | 74  | 114                         | 83  | 78 | 78  | 74 | 78  | 80 | 85  |    |     |    |     |    |     |                |     | 16         | 114 | 74  | 11   |    |
| 12        |            | 84  | 180                         | 84  | 84 | 86  | 87 | 89  |    |     |    |     |    | 89  | 87 | 86  | 84             |     | 6          | 180 | 84  | 12   |    |
| 13        |            | 74  | 114                         | 83  |    |     |    |     |    |     |    |     |    | 85  | 80 | 76  | 78             |     | 16         | 114 | 74  | 13   |    |
| 14        |            | 61  | 106                         | 81  |    |     |    |     |    |     |    |     |    | 75  | 67 | 62  | 61             | 84  | 71         | 106 | 61  | 14   |    |
| 15        |            | 47  | 104                         | 77  |    |     |    |     |    |     |    |     |    | 83  | 64 | 53  | 48             | 47  | 61         | 104 | 47  | 15   |    |
| 16        |            | 33  | 105                         | 68  |    |     |    |     |    |     |    |     |    | 79  | 52 | 36  | 34             | 33  | 36         | 105 | 33  | 16   |    |
| 17        |            | 19  | 107                         | 49  |    |     |    |     |    |     |    |     |    | 73  | 36 | 24  | 20             | 19  | 21         | 107 | 19  | 17   |    |
| 18        |            | 5   | 109                         | 14  |    |     |    |     |    |     |    |     |    | 56  | 11 | 6   | 5              | 5   | 7          | 109 | 5   | 18   |    |
| JUN       |            | 6   | 5                           | 113 | 14 | 8   | 6  | 5   | 6  | 8   | 14 |     |    |     |    |     |                |     |            | 85  | 113 | 5    | 6  |
|           |            | 7   | 19                          | 111 | 45 | 27  | 21 | 19  | 20 | 25  | 40 | 84  |    |     |    |     |                |     |            | 71  | 111 | 19   | 7  |
|           |            | 8   | 33                          | 109 | 63 | 45  | 36 | 33  | 35 | 41  | 56 |     |    |     |    |     |                |     |            | 58  | 109 | 33   | 8  |
|           |            | 9   | 46                          | 109 | 72 | 58  | 50 | 46  | 49 | 55  | 66 |     |    |     |    |     |                |     |            | 44  | 109 | 46   | 9  |
|           | 10         | 60  | 113                         | 77  | 68 | 62  | 60 | 62  | 68 | 78  |    |     |    |     |    |     |                |     |            |     |     |      |    |

ภาคผนวก ข. 1) ตารางแสดงค่าความสว่างท้องฟ้า  
เมื่อพิจารณาจากเส้นรุ้ง (Latitude) ของตำแหน่งที่ตั้ง

(ที่มา : Daylight International Recommendations for the Calculation of Natural Daylight , 1970)





## ภาคผนวก ข. ความสัมพันธ์ระหว่างปริมาณความสว่าง และปริมาณรังสีจากดวงอาทิตย์

ในสภาพท้องฟ้าที่มีความแตกต่างกันพลังงานแสงอาทิตย์จะประกอบด้วย อินฟราเรด, อัลตราไวโอเล็ต, และรังสีของคลื่นแสง ซึ่งค่าต่างๆเหล่านี้สามารถที่จะแปรเปลี่ยนเป็นแสงสว่างจากดวงอาทิตย์ได้ โดยเทียบหนึ่งต่อหนึ่งหน่วยของแสงสว่าง ต่อหน่วยของปริมาณ รังสีจากดวงอาทิตย์ ประสิทธิภาพความส่องสว่าง ของดวงอาทิตย์ จะแปรผันตามปริมาณพลังงานจากรังสีดวงอาทิตย์ ที่ประกอบด้วยช่วงคลื่น ที่มีความยาวคลื่นระหว่างช่วงคลื่นแสงที่มองเห็นและไม่เห็น (อินฟราเรด และ อัลตราไวโอเล็ต) และตัวแปรที่มีอิทธิพลของลักษณะท้องฟ้าโปร่ง, ท้องฟ้ามีเมฆปกคลุมทึบและค่าเฉลี่ยจากท้องฟ้า (clear, overcast, average sky) และมุมอัลติจูด , มุมอัลจิมุทของดวงอาทิตย์ ซึ่งในส่วนสำคัญประสิทธิภาพของความสว่างจะแยกออกเป็น จากดวงอาทิตย์เพียงอย่างเดียว, จากท้องฟ้าเพียงอย่างเดียว และจากปริมาณรังสีรวมของดวงอาทิตย์และท้องฟ้า (Global Radiation Sun Plus Sky)

จากข้อมูลที่ได้อีก จะพบว่าประสิทธิภาพความสว่างของแสงอาทิตย์ ที่ได้จากการตรวจวัดจะมีความส่องสว่าง และปริมาณรังสีของดวงอาทิตย์ในแนวทางเดียวกัน เมื่อทดสอบโดยการวัดประสิทธิภาพ ความส่องสว่างในหน่วย ลูเมนต่อวัตต์ (lumen per watt) ในลักษณะของปริมาณความสว่าง ต่อหนึ่งหน่วยพื้นที่ เทียบกับความเข้มของรังสี จากดวงอาทิตย์ต่อหน่วยพื้นที่เดียวกัน และผลจากข้อมูลข้างต้น ได้แสดงให้เห็นว่าท้องฟ้าโปร่ง และ ท้องฟ้ามีเมฆปกคลุมทึบ จะมีผลเพียงเล็กน้อยต่อประสิทธิภาพ ของความส่องสว่าง ความมุมของดวงอาทิตย์ (ในแต่ละช่วงเวลาของปี) แต่จะมีการลดลงอย่างมาก ของปริมาณรังสีตรงดวงอาทิตย์ (Sun's direct radiation) จะเกิดขึ้นเมื่อ มุมอัลติจูดของดวงอาทิตย์มีค่าน้อยกว่า 30 องศา อย่างไรก็ตามการเปรียบเทียบผลในยุคแรกนั้น อาจมีความคลาดเคลื่อนของผลจากอุปกรณ์ที่ใช้ตรวจสอบได้ แต่ในปัจจุบันเครื่องมือที่ใช้ได้มีการพัฒนาให้มีความแม่นยำสูง การวัดประสิทธิภาพของแสงสว่างจากดวงอาทิตย์ จากเครื่องมือที่ทันสมัย ทำให้ผลที่ได้จากการตรวจสอบมีความถูกต้อง และ สามารถเชื่อถือได้ ซึ่งสามารถสรุปผลการศึกษารายงาน ได้ดังนี้

ความสามารถในการวัดความสัมพันธ์ ของรังสีกระจายทั้งหมด (Global radiation) จากท้องฟ้าโปร่ง, ท้องฟ้ามีเมฆปกคลุมทึบ (Clear sky , Overcast sky and Average sky) ซึ่งมีค่าเฉลี่ยของความสว่าง ที่พบอยู่ระหว่าง 119 +/- 2 , 120 +/- 5 และ 116 +/- 7 ลูเมนต่อวัตต์ (lm/W) ตามลำดับ และค่าเฉลี่ยของท้องฟ้า ที่เป็นแบบรวม (Global radiation) จะพบว่ามีความแตกต่างกันจากน้อยที่สุด 105 lm/W ในเดือนมีนาคมถึง 128 lm/W ในเดือนพฤศจิกายน แต่แท้จริงแล้ว จุดประสงค์ในการศึกษาเรื่องแสงสว่างนั้น ค่าของแสงสว่างที่นำมาใช้งานจะเป็นค่าของความสว่างจากดวงอาทิตย์ และจากท้องฟ้าในลักษณะต่างๆ เป็นตัวกำหนดด้วย นอกจากนั้น จากการแสดงข้อมูลด้วยกราฟการกระจายแสงของดวงอาทิตย์ จะแสดงให้เห็นถึงค่าที่เกือบคงที่ค่าหนึ่งของประสิทธิภาพของความสว่าง ซึ่งจะได้ประมาณ 117 lm/W สำหรับมุมอัลติจูดของดวงอาทิตย์ ที่มากกว่า 25 องศา และจะลดลงเหลือ 90 lm/W เมื่อมุมอัลติจูดของดวงอาทิตย์เท่ากับ 7½ องศา โดยทั่วไปเพื่อสะดวกในการคำนวณจะใช้ค่าความสว่าง 100 lm/w ซึ่งสามารถยอมรับได้ในความถูกต้อง และความสว่างของดวงอาทิตย์ ในสภาพท้องฟ้าที่ปราศจากเมฆปกคลุม (ท้องฟ้าโปร่ง) จะต่ำกว่าประมาณ 20%

จากการทดสอบทั่วไป ไม่ได้แสดงให้เห็นถึงความสว่าง ที่ได้จากรังสีดวงอาทิตย์ ของค่าเฉลี่ยจากท้องฟ้า ที่จะตรงข้ามกับค่ารวมของ ปริมาณรังสีจากดวงอาทิตย์ (Global Radiation) แต่การรวมกันของค่าเฉลี่ยของรังสีจากท้องฟ้าที่เกี่ยวกับค่าเฉลี่ยความสว่างของท้องฟ้า และจากรายงานที่เกี่ยวข้อง จะใช้ค่าเฉลี่ยที่เท่ากับ 125 ลูเมนต่อวัตต์ เป็นค่ามาตรฐาน ในการพิจารณาความสว่างของแสงจากท้องฟ้าตลอดทั้งปี และจากการพิจารณาถึง ค่าสูงสุด ของการกระจายสเปกตรัม ของพลังงาน จากรังสีดวงอาทิตย์ ในสภาพท้องฟ้าโปร่ง จากคลื่นสั้น

เปรียบเทียบกับท้องฟ้า แบบมีเมฆปกคลุมทั้งหมด ที่สามารถจะลดทอนความสัมพัทธ์ ระหว่างปริมาณ ของพลังงานในคลื่นแสงอินฟราเรด ที่เป็นส่วนหนึ่งของสเปกตรัมคลื่นแสงทั้งหมดนั้น จะมีผลทำให้ประสิทธิภาพ ของความสว่างของแสงในท้องฟ้าโปร่ง เพิ่มขึ้นเป็น 150 ลูเมนต่อวัตต์

การหาค่าเฉลี่ยความสว่าง (Average Illumination) ของแสงจากดวงอาทิตย์ หรือท้องฟ้า จากค่าของรังสีดวงอาทิตย์ (Solar Radiation) และ การแปลงค่าเฉลี่ยของรังสีจากดวงอาทิตย์ หรือท้องฟ้า สามารถเปลี่ยนแปลงได้ดังสมการต่อไปนี้

$$\text{Average sun/sky illumination (lm/ft}^2\text{)} = \text{Average sun/sky radiation (w/ft}^2\text{)} \\ \times \text{luminous efficiency of sun/sky radiation (lm/W)}$$

หากอัตราส่วนค่ารังสีดวงอาทิตย์ต่อค่ารังสีจากท้องฟ้า (Sun / Sky radiation) มีหน่วยเป็น มิลลิวัตต์ต่อตารางเซนติเมตร (milliwatts per sq.cm. , mW/cm<sup>2</sup>) ซึ่งเป็นหน่วยของที่ใช้ในกรมอุตุนิยมหาวิทยาลัยของอังกฤษ จะมีส่วนในการแปลงดังนี้

$$\text{Average sun/sky illumination (lm/ft}^2\text{)} = 0.929 \times \text{Average sun/sky radiation (mw/ft}^2\text{)} \\ \times \text{luminous efficiency of sun/sky radiation (lm/W)}$$

และจากสมการข้างต้น IES. (Illuminating Engineering Society) ได้ใช้ในการอ้างอิงในการคำนวณหาค่าประสิทธิภาพความสว่าง (Luminous efficiency) ของท้องฟ้าเป็นรายชั่วโมง ตลอดทั้งปีของเมือง Eskdalemuir ในทางใต้ของประเทศสกอตแลนด์(Southern Scotland)และเมืองเลวิก (Lerwick) บนเกาะไอสแลนด์ (Shetland, Island) ซึ่งค่าความสว่างของรังสีจากดวงอาทิตย์ที่ใช้ในการคำนวณสามารถพิจารณาได้จากตารางข้างล่างนี้

| Source                        | Luminous efficiency (lm/W) |
|-------------------------------|----------------------------|
| Sun (solar altitude < 7 1/2°) | 90                         |
| Sun (solar altitude > 25°)    | 117                        |
| Sun (suggested mean)          | 100                        |
| Sky (clear)                   | 150                        |
| Sky (average)                 | 125                        |
| Global (average)              | 115                        |

ตารางแสดงค่าประสิทธิภาพความสว่าง (Luminous efficiency)  
ของแสงสว่างธรรมชาติ หน่วยเป็น ลูเมน ต่อวัตต์  
ที่มา : Daylighting by R.G.Hopkinson, PhD, page 51

## ภาคผนวก ค. ข้อมูลที่ได้จากการศึกษา

## AVERAGE RAW DATA FROM STATION

| Date     | Time    | Global-R   | Diffuse-R  | Ho    | N     | S     | E     | W     | SC        | SAIt  | SAzm   | SHr    | Std   | Stime |
|----------|---------|------------|------------|-------|-------|-------|-------|-------|-----------|-------|--------|--------|-------|-------|
| (julian) | (clock) | (watt/sqm) | (watt/sqm) | (Lux) | (Lux) | (Lux) | (Lux) | (Lux) | sky ratio |       |        |        |       |       |
| 104      | 40      | 700        | 13.41      | 10.15 | 690   | 723   | 608.4 | 465.4 | 0.76      | 2.72  | -73.61 | -83.03 | 7.00  | 6.46  |
| 104      | 40      | 705        | 21.47      | 15.93 | 987   | 1143  | 943   | 642.4 | 0.74      | 3.88  | -73.27 | -81.78 | 7.08  | 6.55  |
| 104      | 40      | 710        | 31.32      | 22.68 | 1326  | 1682  | 1349  | 856   | 0.72      | 5.03  | -72.93 | -80.53 | 7.17  | 6.63  |
| 104      | 40      | 715        | 42.52      | 30.22 | 1685  | 2394  |       | 1061  | 0.71      | 6.19  | -72.58 | -79.28 | 7.25  | 6.71  |
| 104      | 40      | 720        | 55.63      | 38.65 |       | 3295  | 2360  | 1277  | 0.69      | 7.34  | -72.22 | -78.03 | 7.33  | 6.80  |
| 104      | 40      | 725        | 68.78      | 46.52 | 2373  | 4252  | 2984  | 1474  | 0.68      | 8.49  | -71.85 | -76.78 | 7.42  | 6.88  |
| 104      | 40      | 730        | 83.1       | 53.61 | 2734  | 5298  | 3435  | 1672  | 0.65      | 9.64  | -71.47 | -75.53 | 7.50  | 6.96  |
| 104      | 40      | 735        | 97.4       | 59.49 | 3067  | 6280  | 3940  |       | 0.61      | 10.79 | -71.09 | -74.28 | 7.58  | 7.05  |
| 104      | 40      | 740        | 113        | 64.92 | 3414  | 7160  | 4492  | 2058  | 0.57      | 11.93 | -70.69 | -73.03 | 7.67  | 7.13  |
| 104      | 40      | 745        | 131.5      | 71.3  | 3787  | 7960  | 5072  | 2284  | 0.54      | 13.07 | -70.28 | -71.78 | 7.75  | 7.21  |
| 104      | 40      | 750        | 152.2      | 77.4  | 4175  | 8510  | 5732  | 2518  | 0.51      | 14.20 | -69.87 | -70.53 | 7.83  | 7.30  |
| 104      | 40      | 755        | 171        | 80.3  | 4486  | 8540  | 6269  | 2688  | 0.47      | 15.34 | -69.44 | -69.28 | 7.92  | 7.38  |
| 104      | 40      | 800        | 188.5      | 80.3  | 4706  | 8470  | 6698  | 2816  | 0.43      | 16.47 | -69.00 | -68.03 | 8.00  | 7.46  |
| 104      | 40      | 805        | 204.9      | 79    | 4891  | 8550  | 7060  | 2921  | 0.39      | 17.60 | -68.55 | -66.78 | 8.08  | 7.55  |
| 104      | 40      | 810        | 217.6      | 77.8  | 5119  | 8690  | 7360  | 2993  | 0.36      | 18.72 | -68.09 | -65.53 | 8.17  | 7.63  |
| 104      | 40      | 815        | 237.5      | 78.3  | 5431  | 9210  | 7810  | 3155  | 0.33      | 19.84 | -67.61 | -64.28 | 8.25  | 7.71  |
| 104      | 40      | 820        | 259.8      | 79.9  | 5686  | 9880  | 8220  | 3339  | 0.31      | 20.96 | -67.12 | -63.03 | 8.33  | 7.80  |
| 104      | 40      | 825        | 280.3      | 81.6  | 5848  | 11920 | 8590  | 3445  | 0.29      | 22.07 | -66.62 | -61.78 | 8.42  | 7.88  |
| 104      | 40      | 830        | 290.3      | 83.7  | 6006  | 17280 | 8790  | 3519  | 0.29      | 23.18 | -66.10 | -60.53 | 8.50  | 7.96  |
| 104      | 40      | 835        | 285.1      | 83.3  | 5953  |       | 8600  | 3537  | 0.29      | 24.28 | -65.57 | -59.28 | 8.58  | 8.05  |
| 104      | 40      | 840        | 325.9      | 87.5  | 6191  | 23550 | 9220  | 3705  | 0.27      | 25.38 | -65.01 | -58.03 | 8.67  | 8.13  |
| 104      | 40      | 845        | 351.6      | 92.1  | 6472  | 25180 | 9780  | 3856  | 0.26      | 26.47 | -64.45 | -56.78 | 8.75  | 8.21  |
| 104      | 40      | 850        | 364.6      | 94.8  | 6629  | 25980 | 9980  | 3938  | 0.26      | 27.56 | -63.86 | -55.53 | 8.83  | 8.30  |
| 104      | 40      | 855        | 383.6      | 97.2  | 6766  | 27250 | 10190 | 4026  | 0.25      | 28.64 | -63.26 | -54.28 | 8.92  | 8.38  |
| 104      | 40      | 900        | 396.4      | 99.6  | 6907  | 27870 | 10370 | 4118  | 0.25      | 29.72 | -62.63 | -53.03 | 9.00  | 8.46  |
| 104      | 40      | 905        | 417.1      | 102.6 | 7130  | 29250 | 10680 | 4239  | 0.25      | 30.79 | -61.99 | -51.78 | 9.08  | 8.55  |
| 104      | 40      | 910        | 434.9      | 105.3 | 7280  | 30520 | 10890 | 4363  | 0.24      | 31.85 | -61.32 | -50.53 | 9.17  | 8.63  |
| 104      | 40      | 915        | 455.2      | 108.5 | 7460  | 31940 | 11100 | 4502  | 0.24      | 32.91 | -60.64 | -49.28 | 9.25  | 8.71  |
| 104      | 40      | 920        | 476.1      | 111.7 | 7600  | 33200 | 11330 | 4631  | 0.23      | 33.96 | -59.92 | -48.03 | 9.33  | 8.80  |
| 104      | 40      | 925        | 491.9      | 115.1 | 7730  | 33900 | 11510 | 4748  | 0.23      | 35.00 | -59.19 | -46.78 | 9.42  | 8.88  |
| 104      | 40      | 930        | 508.2      | 116.4 | 7790  | 35020 | 11460 | 4833  | 0.23      | 36.04 | -58.42 | -45.53 | 9.50  | 8.96  |
| 104      | 40      | 935        | 523.3      | 117.4 | 7820  | 36120 | 11460 | 4921  | 0.22      | 37.06 | -57.63 | -44.28 | 9.58  | 9.05  |
| 104      | 40      | 940        | 548.2      | 120.2 | 7970  | 37450 | 11650 | 5041  | 0.22      | 38.08 | -56.81 | -43.03 | 9.67  | 9.13  |
| 104      | 40      | 945        | 568.4      | 122.3 | 8080  | 38730 | 11680 | 5139  | 0.22      | 39.09 | -55.96 | -41.78 | 9.75  | 9.21  |
| 104      | 40      | 950        | 576.7      | 124.7 | 8140  | 38810 | 11740 | 5214  | 0.22      | 40.09 | -55.08 | -40.53 | 9.83  | 9.30  |
| 104      | 40      | 955        | 595        | 126.9 | 8250  | 39720 | 11840 | 5314  | 0.21      | 41.07 | -54.16 | -39.28 | 9.92  | 9.38  |
| 104      | 40      | 1000       | 605.4      | 128.3 | 8310  | 39910 | 11890 | 5377  | 0.21      | 42.05 | -53.21 | -38.03 | 10.00 | 9.46  |
| 104      | 40      | 1005       | 617.9      | 131.5 | 8380  | 39790 | 11880 | 5466  | 0.21      | 43.01 | -52.22 | -36.78 | 10.08 | 9.55  |
| 104      | 40      | 1010       | 628        | 132.1 | 8420  | 39610 | 11850 | 5441  | 0.21      | 43.96 | -51.19 | -35.53 | 10.17 | 9.63  |
| 104      | 40      | 1015       | 636.6      | 131.7 | 8420  | 39540 | 11750 | 5475  | 0.21      | 44.89 | -50.13 | -34.28 | 10.25 | 9.71  |
| 104      | 40      | 1020       | 666.9      | 135   | 8560  | 40180 | 11900 | 5600  | 0.20      | 45.81 | -49.01 | -33.03 | 10.33 | 9.80  |
| 104      | 40      | 1025       | 683.5      | 134.3 | 8600  | 40260 | 11820 | 5640  | 0.20      | 46.72 | -47.86 | -31.78 | 10.42 | 9.88  |
| 104      | 40      | 1030       | 695.3      | 135.6 | 8670  | 39500 | 11800 | 5709  | 0.20      | 47.61 | -46.66 | -30.53 | 10.50 | 9.96  |
| 104      | 40      | 1035       | 708        | 135.5 | 8690  | 37780 | 11640 | 5778  | 0.19      | 48.48 | -45.41 | -29.28 | 10.58 | 10.05 |
| 104      | 40      | 1040       | 731        | 137.6 | 8800  | 37340 | 11670 | 5909  | 0.19      | 49.33 | -44.11 | -28.03 | 10.67 | 10.13 |
| 104      | 40      | 1045       | 741        | 137.8 | 8840  | 35820 | 11510 | 5996  | 0.19      | 50.16 | -42.75 | -26.78 | 10.75 | 10.21 |
| 104      | 40      | 1050       | 751        | 137.9 | 8820  | 34470 | 11320 | 6042  | 0.18      | 50.97 | -41.34 | -25.53 | 10.83 | 10.30 |
| 104      | 40      | 1055       | 755        | 138.9 | 8810  | 32210 | 11140 | 6111  | 0.18      | 51.76 | -39.88 | -24.28 | 10.92 | 10.38 |
| 104      | 40      | 1100       | 766        | 139.5 | 8790  | 30130 | 10950 | 6168  | 0.18      | 52.52 | -38.36 | -23.03 | 11.00 | 10.46 |
| 104      | 40      | 1105       | 773        | 140   | 8790  | 27650 | 10770 | 6239  | 0.18      | 53.26 | -36.77 | -21.78 | 11.08 | 10.55 |
| 104      | 40      | 1110       | 781        | 141.6 | 8800  | 26040 | 10630 | 6342  | 0.18      | 53.97 | -35.13 | -20.53 | 11.17 | 10.63 |
| 104      | 40      | 1115       | 791        | 142.4 | 8820  | 24950 | 10480 | 6410  | 0.18      | 54.65 | -33.42 | -19.28 | 11.25 | 10.71 |
| 104      | 40      | 1120       | 802        | 144   | 8870  | 24400 | 10340 | 6532  | 0.18      | 55.30 | -31.65 | -18.03 | 11.33 | 10.80 |



## AVERAGE RAW DATA FROM STATION

| Date     | Time    | Global-R   | Diffuse-R  | Ho    | N     | S     | E     | W     | SC        | SAIt  | SAzm   | SHr    | Std   | Stime |
|----------|---------|------------|------------|-------|-------|-------|-------|-------|-----------|-------|--------|--------|-------|-------|
| (julian) | (clock) | (watt/sqm) | (watt/sqm) | (Lux) | (Lux) | (Lux) | (Lux) | (Lux) | sky ratio |       |        |        |       |       |
| 104      | 41      | 700        | 15.1       | 11.06 | 594   | 585.3 | 530.2 | 378.4 | 0.73      | 2.80  | -73.91 | -83.03 | 7.00  | 8.46  |
| 104      | 41      | 705        | 23.73      | 17.34 | 915   | 940   | 839   | 564.5 | 0.73      | 3.96  | -73.57 | -81.78 | 7.08  | 6.55  |
| 104      | 41      | 710        | 32.94      | 23.88 | 1252  | 1327  | 1214  | 750   | 0.72      | 5.12  | -73.23 | -80.53 | 7.17  | 6.83  |
| 104      | 41      | 715        | 45.1       | 32.33 | 1677  | 1472  | 1318  | 995   | 0.72      | 6.27  | -72.88 | -79.28 | 7.25  | 6.71  |
| 104      | 41      | 720        | 57.59      | 40.67 |       | 2317  | 2108  | 1198  | 0.71      | 7.43  | -72.52 | -78.03 | 7.33  | 6.80  |
| 104      | 41      | 725        | 68.88      | 47.77 | 2494  | 2795  | 2631  | 1397  | 0.89      | 8.58  | -72.15 | -76.78 | 7.42  | 6.88  |
| 104      | 41      | 730        | 81.2       | 54.7  | 2901  | 3351  | 3187  | 1592  | 0.87      | 9.73  | -71.77 | -75.53 | 7.50  | 6.96  |
| 104      | 41      | 735        | 94.3       | 61.22 | 3246  | 3927  | 3719  | 1767  | 0.85      | 10.88 | -71.39 | -74.28 | 7.58  | 7.05  |
| 104      | 41      | 740        | 103.1      | 65.11 | 3487  | 4296  | 4081  |       | 0.83      | 12.02 | -70.99 | -73.03 | 7.67  | 7.13  |
| 104      | 41      | 745        | 111.5      | 67.93 | 3679  | 4693  | 4372  | 2100  | 0.81      | 13.16 | -70.59 | -71.78 | 7.75  | 7.21  |
| 104      | 41      | 750        | 124.8      | 72.3  | 3988  | 5201  | 4822  | 2328  | 0.58      | 14.30 | -70.17 | -70.53 | 7.83  | 7.30  |
| 104      | 41      | 755        | 131.4      | 73.4  | 4267  | 5604  | 5138  | 2636  | 0.56      | 15.44 | -69.74 | -69.28 | 7.92  | 7.38  |
| 104      | 41      | 800        | 155.8      | 80.1  | 4713  | 6642  | 5918  | 2834  | 0.51      | 16.57 | -69.31 | -68.03 | 8.00  | 7.48  |
| 104      | 41      | 805        | 177        | 84.5  | 5112  | 7410  | 6628  | 3043  | 0.48      | 17.70 | -68.86 | -66.78 | 8.08  | 7.55  |
| 104      | 41      | 810        | 179.6      | 83.6  | 5203  | 7530  | 6669  | 3130  | 0.47      | 18.83 | -68.39 | -65.53 | 8.17  | 7.63  |
| 104      | 41      | 815        | 195.8      | 87.2  | 5415  | 8390  | 7060  | 3300  | 0.45      | 19.95 | -67.92 | -64.28 | 8.25  | 7.71  |
| 104      | 41      | 820        | 205.9      | 89.9  | 5643  | 8730  | 7390  | 3380  | 0.44      | 21.07 | -67.43 | -63.03 | 8.33  | 7.80  |
| 104      | 41      | 825        | 216.2      | 93.4  | 5870  | 10210 | 7750  | 3499  | 0.43      | 22.18 | -66.93 | -61.78 | 8.42  | 7.88  |
| 104      | 41      | 830        | 232.6      | 97    | 6082  | 13190 | 8210  | 3646  | 0.42      | 23.29 | -66.41 | -60.53 | 8.50  | 7.96  |
| 104      | 41      | 835        | 250        | 102.5 | 6357  | 15020 | 8650  | 3899  | 0.41      | 24.40 | -65.88 | -59.28 | 8.58  | 8.05  |
| 104      | 41      | 840        | 268.4      | 108.3 | 6742  | 16200 | 9090  | 4109  | 0.40      | 25.50 | -65.33 | -58.03 | 8.67  | 8.13  |
| 104      | 41      | 845        | 288.4      | 113.5 | 7150  | 17460 | 9520  | 4316  | 0.39      | 26.60 | -64.76 | -56.78 | 8.75  | 8.21  |
| 104      | 41      | 850        | 315.8      | 118.3 | 7480  |       | 10100 | 4494  | 0.37      | 27.69 | -64.18 | -55.53 | 8.83  | 8.30  |
| 104      | 41      | 855        | 341.2      | 122.4 | 7700  | 21910 | 10670 | 4603  | 0.36      | 28.77 | -63.58 | -54.28 | 8.92  | 8.38  |
| 104      | 41      | 900        | 380.8      | 128.6 | 8040  | 24840 | 11360 | 4837  | 0.34      | 29.85 | -62.95 | -53.03 | 9.00  | 8.46  |
| 104      | 41      | 905        | 404.5      | 132.3 | 8310  | 26110 | 11710 | 4998  | 0.33      | 30.93 | -62.31 | -51.78 | 9.08  | 8.55  |
| 104      | 41      | 910        | 428.1      | 135.2 | 8520  | 27790 | 12020 | 5106  | 0.32      | 31.99 | -61.65 | -50.53 | 9.17  | 8.63  |
| 104      | 41      | 915        | 446.9      | 137.7 | 8760  | 29010 | 12380 | 5223  | 0.31      | 33.05 | -60.96 | -49.28 | 9.25  | 8.71  |
| 104      | 41      | 920        | 465.6      | 139.2 | 8910  | 30290 | 12610 | 5350  | 0.30      | 34.11 | -60.25 | -48.03 | 9.33  | 8.80  |
| 104      | 41      | 925        | 483.1      | 139.8 | 8990  | 31240 | 12720 | 5457  | 0.29      | 35.15 | -59.51 | -46.78 | 9.42  | 8.88  |
| 104      | 41      | 930        | 498.3      | 140.4 | 8990  | 31760 | 12800 | 5518  | 0.28      | 36.19 | -58.75 | -45.53 | 9.50  | 8.96  |
| 104      | 41      | 935        | 505.9      | 141.9 | 8980  | 31050 | 12780 | 5546  | 0.28      | 37.22 | -57.96 | -44.28 | 9.58  | 9.05  |
| 104      | 41      | 940        | 516.5      | 144.8 | 8950  | 30180 | 12830 | 5622  | 0.28      | 38.24 | -57.14 | -43.03 | 9.67  | 9.13  |
| 104      | 41      | 945        | 544.2      | 149.7 | 9120  | 29440 | 13140 | 5753  | 0.28      | 39.25 | -56.30 | -41.78 | 9.75  | 9.21  |
| 104      | 41      | 950        | 562.1      | 151.9 | 9230  | 27920 | 13280 | 5796  | 0.27      | 40.25 | -55.41 | -40.53 | 9.83  | 9.30  |
| 104      | 41      | 955        | 568.7      | 152.5 | 9240  | 25730 | 13160 | 5833  | 0.27      | 41.24 | -54.50 | -39.26 | 9.92  | 9.38  |
| 104      | 41      | 1000       | 575.5      | 157.2 | 9340  | 23630 | 13360 | 5923  | 0.27      | 42.22 | -53.55 | -38.03 | 10.00 | 9.46  |
| 104      | 41      | 1005       | 574.5      | 158.6 | 9270  | 21870 | 13140 | 5921  | 0.28      | 43.19 | -52.56 | -36.78 | 10.08 | 9.55  |
| 104      | 41      | 1010       | 590.4      | 162.9 | 9350  | 21490 | 13090 | 6072  | 0.28      | 44.14 | -51.54 | -35.53 | 10.17 | 9.63  |
| 104      | 41      | 1015       | 600.4      | 165.5 | 9410  | 21260 | 13180 | 6027  | 0.28      | 45.08 | -50.47 | -34.28 | 10.25 | 9.71  |
| 104      | 41      | 1020       | 582.2      | 162.8 | 9170  | 20740 | 12690 | 5888  | 0.28      | 46.01 | -49.36 | -33.03 | 10.33 | 9.80  |
| 104      | 41      | 1025       | 594.5      | 165.3 | 9180  | 20790 | 12740 | 5959  | 0.28      | 46.92 | -48.20 | -31.78 | 10.42 | 9.88  |
| 104      | 41      | 1030       | 614        | 167   | 9290  | 20750 | 12550 | 6026  | 0.27      | 47.81 | -47.00 | -30.53 | 10.50 | 9.96  |
| 104      | 41      | 1035       | 624.4      | 169.7 | 9360  | 21090 | 12440 | 6208  | 0.27      | 48.69 | -45.75 | -29.28 | 10.58 | 10.05 |
| 104      | 41      | 1040       | 660.6      | 177.8 | 9750  | 22150 | 12910 | 6560  | 0.27      | 49.54 | -44.45 | -28.03 | 10.67 | 10.13 |
| 104      | 41      | 1045       | 693.5      | 182.6 | 10040 | 22680 | 13150 | 6750  | 0.26      | 50.38 | -43.09 | -26.78 | 10.75 | 10.21 |
| 104      | 41      | 1050       | 680.5      | 185.7 | 10020 | 22690 | 12960 | 6850  | 0.27      | 51.19 | -41.68 | -25.53 | 10.83 | 10.30 |
| 104      | 41      | 1055       | 694.1      | 189.9 | 10100 | 23100 | 12870 | 7040  | 0.27      | 51.99 | -40.21 | -24.28 | 10.92 | 10.38 |
| 104      | 41      | 1100       | 674        | 193.5 | 10080 | 22640 | 12550 | 7030  | 0.29      | 52.76 | -38.68 | -23.03 | 11.00 | 10.46 |
| 104      | 41      | 1105       | 626.1      | 190.2 | 9770  | 21560 | 11840 | 6859  | 0.30      | 53.50 | -37.09 | -21.78 | 11.08 | 10.55 |
| 104      | 41      | 1110       | 616.7      | 189   | 9670  | 21310 | 11610 | 6742  | 0.31      | 54.21 | -35.44 | -20.53 | 11.17 | 10.63 |
| 104      | 41      | 1115       | 628.8      | 192.1 | 9740  | 21800 | 11530 | 7020  | 0.31      | 54.90 | -33.73 | -19.28 | 11.25 | 10.71 |
| 104      | 41      | 1120       | 678.5      | 204   | 10300 | 23060 | 12120 | 7470  | 0.30      | 55.56 | -31.95 | -18.03 | 11.33 | 10.80 |
| 104      | 41      | 1125       | 673.6      | 203.1 | 10400 | 23030 | 11990 | 7610  | 0.30      | 56.18 | -30.10 | -16.78 | 11.42 | 10.88 |

## AVERAGE RAW DATA FROM STATION

| Date     | Time    | Global-R   | Diffuse-R  | Ho    | N     | S     | E     | W     | SC        | SAIt  | SAzm   | SHr    | Std   | Stime |
|----------|---------|------------|------------|-------|-------|-------|-------|-------|-----------|-------|--------|--------|-------|-------|
| (Julian) | (clock) | (watt/sqm) | (watt/sqm) | (Lux) | (Lux) | (Lux) | (Lux) | (Lux) | sky ratio |       |        |        |       |       |
| 104      | 39      | 700        | 16.41      | 12.41 | 738   | 830   | 717   | 475.9 | 0.76      | 2.65  | -73.32 | -83.01 | 7.00  | 6.47  |
| 104      | 39      | 705        | 23.88      | 17.95 | 1041  | 1169  | 1038  | 673.3 | 0.75      | 3.80  | -72.98 | -81.76 | 7.08  | 6.55  |
| 104      | 39      | 710        | 35.12      | 25.63 | 1406  | 1648  | 1495  | 873   | 0.73      | 4.96  | -72.64 | -80.61 | 7.17  | 6.63  |
| 104      | 39      | 715        | 46.01      | 32.76 | 1751  |       |       | 1079  | 0.71      | 6.11  | -72.28 | -79.26 | 7.25  | 6.72  |
| 104      | 39      | 720        | 55.56      | 38.77 | 2051  | 2571  | 2358  | 1276  | 0.70      | 7.26  | -71.92 | -78.01 | 7.33  | 6.80  |
| 104      | 39      | 725        | 71.2       | 48.76 | 2482  | 3183  | 2964  | 1519  | 0.68      | 8.41  | -71.55 | -76.76 | 7.42  | 6.88  |
| 104      | 39      | 730        | 86.8       | 57.86 | 2842  | 3793  | 3531  | 1748  | 0.67      | 9.56  | -71.18 | -75.51 | 7.50  | 6.97  |
| 104      | 39      | 735        | 105        | 66.62 | 3258  | 4423  | 4160  | 1973  | 0.63      | 10.70 | -70.79 | -74.26 | 7.58  | 7.05  |
| 104      | 39      | 740        | 125.4      | 74.2  | 3611  | 5065  | 4770  | 2176  | 0.59      | 11.84 | -70.39 | -73.01 | 7.67  | 7.13  |
| 104      | 39      | 745        | 142.1      | 78.2  | 3920  | 5604  | 5238  | 2338  | 0.55      | 12.98 | -69.99 | -71.76 | 7.75  | 7.22  |
| 104      | 39      | 750        | 158.4      | 81.8  | 4201  | 6052  | 5685  | 2487  | 0.52      | 14.11 | -69.57 | -70.51 | 7.83  | 7.30  |
| 104      | 39      | 755        | 176.6      | 85.4  | 4437  | 6597  | 6139  | 2609  | 0.48      | 15.24 | -69.14 | -69.26 | 7.92  | 7.38  |
| 104      | 39      | 800        | 194.1      | 85.8  | 4670  | 7150  | 6571  | 2745  | 0.44      | 16.37 | -68.70 | -68.01 | 8.00  | 7.47  |
| 104      | 39      | 805        | 215        | 83.8  | 4881  | 7690  | 6957  | 2879  | 0.39      | 17.50 | -68.25 | -66.76 | 8.08  | 7.55  |
| 104      | 39      | 810        | 226.8      | 78.4  | 4991  | 7980  | 7190  | 2941  | 0.35      | 18.62 | -67.79 | -65.51 | 8.17  | 7.63  |
| 104      | 39      | 815        | 216.1      | 70.8  | 4967  | 7920  | 6979  | 2977  | 0.33      | 19.74 | -67.31 | -64.26 | 8.25  | 7.72  |
| 104      | 39      | 820        | 247.9      | 71.2  | 5207  | 8980  | 7480  | 3169  | 0.29      | 20.85 | -66.82 | -63.01 | 8.33  | 7.80  |
| 104      | 39      | 825        | 282.3      | 73.3  | 5563  | 12820 | 8130  | 3364  | 0.26      | 21.96 | -66.31 | -61.76 | 8.42  | 7.88  |
| 104      | 39      | 830        | 306.5      | 74.6  | 5808  | 8620  | 8490  | 3515  | 0.24      | 23.06 | -65.79 | -60.51 | 8.50  | 7.97  |
| 104      | 39      | 835        | 330.9      | 75.5  | 5979  | 2375  | 8740  | 3647  | 0.23      | 24.16 | -65.26 | -59.26 | 8.58  | 8.05  |
| 104      | 39      | 840        | 353.3      | 77.6  | 6130  | 2410  | 8960  | 3757  | 0.22      | 25.26 | -64.70 | -58.01 | 8.67  | 8.13  |
| 104      | 39      | 845        | 368.8      | 79.2  | 6227  | 2290  | 9100  | 3827  | 0.21      | 26.35 | -64.14 | -56.76 | 8.75  | 8.22  |
| 104      | 39      | 850        | 388.7      | 80.7  | 6331  | 2093  | 9190  | 3917  | 0.21      | 27.44 | -63.55 | -55.51 | 8.83  | 8.30  |
| 104      | 39      | 855        | 407.3      | 82.5  | 6442  | 14670 | 9310  | 3998  | 0.20      | 28.52 | -62.94 | -54.26 | 8.92  | 8.38  |
| 104      | 39      | 900        | 426.9      | 84.4  | 6563  | 15810 | 9450  | 4072  | 0.20      | 29.59 | -62.32 | -53.01 | 9.00  | 8.47  |
| 104      | 39      | 905        | 437.5      | 85.5  | 6588  | 13970 | 9430  | 4100  | 0.20      | 30.66 | -61.67 | -51.76 | 9.08  | 8.55  |
| 104      | 39      | 910        | 465.4      | 86.5  | 6742  | 13510 | 9670  | 4215  | 0.19      | 31.72 | -61.00 | -50.51 | 9.17  | 8.63  |
| 104      | 39      | 915        | 481        | 90    | 6862  | 13430 | 9740  | 4283  | 0.19      | 32.77 | -60.31 | -49.26 | 9.25  | 8.72  |
| 104      | 39      | 920        | 504.2      | 91.7  | 7010  | 13690 | 9880  | 4379  | 0.18      | 33.82 | -59.60 | -48.01 | 9.33  | 8.80  |
| 104      | 39      | 925        | 528.5      | 93    | 7150  | 13990 | 9950  | 4485  | 0.18      | 34.86 | -58.86 | -46.76 | 9.42  | 8.88  |
| 104      | 39      | 930        | 544.3      | 93.3  | 7230  | 14210 | 9860  | 4575  | 0.17      | 35.89 | -58.09 | -45.51 | 9.50  | 8.97  |
| 104      | 39      | 935        | 571.5      | 95    | 7320  | 14570 | 9940  | 4660  | 0.17      | 36.91 | -57.30 | -44.26 | 9.58  | 9.05  |
| 104      | 39      | 940        | 589.4      | 96.8  | 7390  | 14740 | 10010 | 4699  | 0.16      | 37.92 | -56.48 | -43.01 | 9.67  | 9.13  |
| 104      | 39      | 945        | 596.7      | 99.2  | 7460  | 14870 | 10120 | 4737  | 0.17      | 38.93 | -55.63 | -41.76 | 9.75  | 9.22  |
| 104      | 39      | 950        | 606.6      | 101.1 | 7490  | 15120 | 10170 | 4793  | 0.17      | 39.92 | -54.74 | -40.51 | 9.83  | 9.30  |
| 104      | 39      | 955        | 623.6      | 102.3 | 7550  | 15330 | 10180 | 4854  | 0.16      | 40.90 | -53.82 | -39.26 | 9.92  | 9.38  |
| 104      | 39      | 1000       | 640.3      | 102.7 | 7570  | 15490 | 10090 | 4909  | 0.16      | 41.87 | -52.87 | -38.01 | 10.00 | 9.47  |
| 104      | 39      | 1005       | 659.4      | 103.6 | 7640  | 15620 | 10030 | 4988  | 0.16      | 42.83 | -51.88 | -36.76 | 10.08 | 9.55  |
| 104      | 39      | 1010       | 689.8      | 104.5 | 7670  | 15630 | 9970  | 5014  | 0.16      | 43.78 | -50.85 | -35.51 | 10.17 | 9.63  |
| 104      | 39      | 1015       | 677.9      | 104.4 | 7660  | 15620 | 9850  | 5017  | 0.15      | 44.71 | -49.79 | -34.26 | 10.25 | 9.72  |
| 104      | 39      | 1020       | 696.4      | 105.8 | 7730  | 15800 | 9920  | 5077  | 0.15      | 45.62 | -48.68 | -33.01 | 10.33 | 9.80  |
| 104      | 39      | 1025       | 711        | 106.8 | 7780  | 15930 | 9890  | 5146  | 0.15      | 46.52 | -47.52 | -31.76 | 10.42 | 9.88  |
| 104      | 39      | 1030       | 726        | 107.8 | 7850  | 16060 | 9860  | 5221  | 0.15      | 47.41 | -46.32 | -30.51 | 10.50 | 9.97  |
| 104      | 39      | 1035       | 740        | 109   | 7910  | 16180 | 9800  | 5287  | 0.15      | 48.27 | -45.07 | -29.26 | 10.58 | 10.05 |
| 104      | 39      | 1040       | 747        | 110.4 | 7960  | 16310 | 9720  | 5347  | 0.15      | 49.12 | -43.77 | -28.01 | 10.67 | 10.13 |
| 104      | 39      | 1045       | 758        | 112   | 7990  | 16460 | 9680  | 5414  | 0.15      | 49.94 | -42.42 | -26.76 | 10.75 | 10.22 |
| 104      | 39      | 1050       | 765        | 113.1 | 8030  | 16520 | 9580  | 5483  | 0.15      | 50.75 | -41.01 | -25.51 | 10.83 | 10.30 |
| 104      | 39      | 1055       | 775        | 114.9 | 8080  | 16720 | 9540  | 5564  | 0.15      | 51.53 | -39.55 | -24.26 | 10.92 | 10.38 |
| 104      | 39      | 1100       | 787        | 115   | 8060  | 16790 | 9390  | 5604  | 0.15      | 52.29 | -38.03 | -23.01 | 11.00 | 10.47 |
| 104      | 39      | 1105       | 795        | 115.3 | 8060  | 16870 | 9230  | 5648  | 0.15      | 53.02 | -36.45 | -21.76 | 11.08 | 10.55 |
| 104      | 39      | 1110       | 817        | 114   | 8100  | 16830 | 8960  | 5732  | 0.14      | 53.72 | -34.82 | -20.51 | 11.17 | 10.63 |
| 104      | 39      | 1115       | 827        | 113.4 | 8120  | 16670 | 8820  | 5775  | 0.14      | 54.40 | -33.12 | -19.26 | 11.25 | 10.72 |
| 104      | 39      | 1120       | 829        | 114.3 | 8120  | 16680 | 8710  | 5837  | 0.14      | 55.04 | -31.35 | -18.01 | 11.33 | 10.80 |
| 104      | 39      | 1125       | 837        | 115.8 | 8160  | 16820 | 8610  | 5930  | 0.14      | 55.66 | -29.53 | -16.76 | 11.42 | 10.88 |

## AVERAGE RAW DATA FROM STATION

|     | Date     | Time    | Global-R   | Diffuse-R  | Ho    | N     | S     | E     | W     | SC        | SAIt  | SAzm   | SHr    | Std   | Stime |
|-----|----------|---------|------------|------------|-------|-------|-------|-------|-------|-----------|-------|--------|--------|-------|-------|
|     | (julian) | (clock) | (watt/sqm) | (watt/sqm) | (Lux) | (Lux) | (Lux) | (Lux) | (Lux) | sky ratio |       |        |        |       |       |
| 104 | 46       | 700     | 10         | 7.84       | 701   | 418.4 | 369   | 299.5 | 355   | 0.78      | 3.24  | -75.45 | -83.03 | 7.00  | 6.46  |
| 104 | 46       | 705     | 13.83      | 11.02      | 1100  | 651   | 457.7 | 510.7 | 351.7 | 0.80      | 4.41  | -75.12 | -81.78 | 7.08  | 6.55  |
| 104 | 46       | 710     | 16.58      | 12.86      | 1348  | 740   | 653.8 | 584.6 | 443.8 | 0.78      | 5.58  | -74.77 | -80.53 | 7.17  | 6.63  |
| 104 | 46       | 715     | 20.73      | 15.72      | 1652  | 988   | 781   | 788   | 616   | 0.76      | 6.74  | -74.42 | -79.28 | 7.25  | 6.71  |
| 104 | 46       | 720     | 26.9       | 20.09      | 2133  | 1185  | 1094  | 1043  | 685.6 | 0.75      | 7.91  | -74.06 | -78.03 | 7.33  | 6.80  |
| 104 | 46       | 725     | 34.81      | 25.37      | 2682  | 1421  | 1457  | 1337  | 698   | 0.73      | 9.07  | -73.70 | -76.78 | 7.42  | 6.88  |
| 104 | 46       | 730     | 43.8       | 31.61      | 3248  | 1407  | 1804  |       | 972   | 0.72      | 10.23 | -73.32 | -75.53 | 7.50  | 6.96  |
| 104 | 46       | 735     | 54.58      | 37.35      | 3837  | 2075  | 2128  | 2194  | 1142  | 0.68      | 11.39 | -72.94 | -74.28 | 7.58  | 7.05  |
| 104 | 46       | 740     | 63.22      | 42.84      | 4389  | 2399  | 2481  | 2515  | 1363  | 0.68      | 12.54 | -72.55 | -73.03 | 7.67  | 7.13  |
| 104 | 46       | 745     | 73.6       | 49.24      | 5045  | 2716  | 2893  | 2933  | 1515  | 0.67      | 13.69 | -72.14 | -71.78 | 7.75  | 7.21  |
| 104 | 46       | 750     | 81.7       | 52.98      | 5424  | 2993  | 3119  | 3214  | 1688  | 0.65      | 14.84 | -71.73 | -70.53 | 7.83  | 7.30  |
| 104 | 46       | 755     | 86         | 57.72      | 5856  | 3172  | 3508  | 3329  |       | 0.67      | 15.99 | -71.31 | -69.28 | 7.92  | 7.38  |
| 104 | 46       | 800     | 100.3      | 65.17      | 6530  | 3572  | 3969  | 3887  | 2072  | 0.65      | 17.13 | -70.88 | -68.03 | 8.00  | 7.46  |
| 104 | 46       | 805     | 109.5      | 72.2       | 7250  | 3926  | 4395  | 4292  | 2254  | 0.66      | 18.28 | -70.43 | -66.78 | 8.08  | 7.55  |
| 104 | 46       | 810     | 117.7      | 75.6       | 7440  | 4079  | 4592  | 4247  | 2426  | 0.64      | 19.41 | -69.97 | -65.53 | 8.17  | 7.63  |
| 104 | 46       | 815     | 135.1      | 84.8       | 8130  | 4314  | 5010  | 4842  | 2537  | 0.63      | 20.55 | -69.51 | -64.28 | 8.25  | 7.71  |
| 104 | 46       | 820     | 152.7      | 97.5       | 9040  | 4941  | 5492  | 5612  | 2796  | 0.64      | 21.68 | -69.02 | -63.03 | 8.33  | 7.80  |
| 104 | 46       | 825     | 172.7      | 106.7      | 10280 | 5472  | 6462  | 6462  | 3047  | 0.62      | 22.81 | -68.53 | -61.78 | 8.42  | 7.88  |
| 104 | 46       | 830     | 181.9      | 109.3      | 10580 | 5836  | 6146  | 6510  | 3262  | 0.68      | 23.93 | -68.02 | -60.53 | 8.50  | 7.96  |
| 104 | 46       | 835     | 189.9      | 114.8      | 10600 | 5922  | 6210  | 6758  | 3379  | 0.60      | 25.05 | -67.49 | -60.28 | 8.58  | 8.05  |
| 104 | 46       | 840     | 184.4      | 112.6      | 10930 | 6123  | 6368  | 6499  | 3576  | 0.61      | 26.18 | -66.95 | -58.03 | 8.67  | 8.13  |
| 104 | 46       | 845     | 203.7      | 129.9      | 12100 | 6418  | 7070  | 6834  | 3737  | 0.64      | 27.27 | -66.39 | -56.78 | 8.75  | 8.21  |
| 104 | 46       | 850     | 182.4      | 123.8      | 11700 | 6611  | 6895  | 6633  | 3951  | 0.68      | 28.38 | -65.82 | -55.53 | 8.83  | 8.30  |
| 104 | 46       | 855     | 207.9      | 134.2      | 13070 | 7070  | 8110  | 7640  | 4350  | 0.65      | 29.48 | -65.23 | -54.28 | 8.92  | 8.38  |
| 104 | 46       | 900     | 198.7      | 135.2      | 13110 | 7220  | 8230  | 7600  | 4493  | 0.68      | 30.57 | -64.61 | -53.03 | 9.00  | 8.46  |
| 104 | 46       | 905     | 238.4      | 152.2      | 14760 | 7970  | 9680  | 8940  | 4850  | 0.64      | 31.66 | -63.98 | -51.78 | 9.08  | 8.55  |
| 104 | 46       | 910     | 303.5      | 164.1      | 16920 | 8820  | 11720 | 10420 | 5192  | 0.54      | 32.75 | -63.33 | -50.53 | 9.17  | 8.63  |
| 104 | 46       | 915     | 295.1      | 163.6      | 16680 | 8720  | 11240 | 9340  | 5346  | 0.55      | 33.83 | -62.65 | -49.28 | 9.25  | 8.71  |
| 104 | 46       | 920     | 312.5      | 172        |       | 8790  | 12230 | 10090 | 5453  | 0.55      | 34.90 | -61.95 | -48.03 | 9.33  | 8.80  |
| 104 | 46       | 925     | 312.6      | 181        | 19150 | 9540  | 11790 | 10490 | 5843  | 0.58      | 35.96 | -61.22 | -46.78 | 9.42  | 8.88  |
| 104 | 46       | 930     | 257.5      | 166.5      |       | 9320  | 12530 | 9160  | 5955  | 0.65      | 37.02 | -60.47 | -45.53 | 9.50  | 8.96  |
| 104 | 46       | 935     | 352.6      | 186.5      | 19560 | 9760  | 13610 | 11800 | 6092  | 0.53      | 38.06 | -59.69 | -44.28 | 9.58  | 9.05  |
| 104 | 46       | 940     | 314.2      | 194.4      | 20220 | 10120 | 14460 | 12130 | 6255  | 0.62      | 39.10 | -58.88 | -43.03 | 9.67  | 9.13  |
| 104 | 46       | 945     | 424.6      | 204.6      | 21700 | 10710 | 16080 | 13560 | 6577  | 0.48      | 40.13 | -58.04 | -41.78 | 9.75  | 9.21  |
| 104 | 46       | 950     | 449        | 205.4      | 22130 | 10790 | 16640 | 14040 | 6537  | 0.46      | 41.15 | -57.17 | -40.53 | 9.83  | 9.30  |
| 104 | 46       | 955     | 437.2      | 202.6      | 21990 | 10760 | 16860 | 13950 | 6583  | 0.46      | 42.17 | -56.26 | -39.28 | 9.92  | 9.38  |
| 104 | 46       | 1000    | 461        | 212.1      | 22690 | 10930 | 15960 | 13140 | 7020  | 0.46      | 43.17 | -55.32 | -38.03 | 10.00 | 9.46  |
| 104 | 46       | 1005    | 325.9      | 201.4      | 21630 | 10870 | 13770 | 11330 | 7000  | 0.62      | 44.15 | -54.34 | -36.78 | 10.08 | 9.55  |
| 104 | 46       | 1010    | 295.4      | 201.4      | 21600 | 11040 | 14100 | 12080 | 6893  | 0.68      | 45.13 | -53.31 | -35.53 | 10.17 | 9.63  |
| 104 | 46       | 1015    | 377.4      | 215        | 21910 | 10980 | 15080 | 11980 | 6903  | 0.57      | 46.09 | -52.25 | -34.28 | 10.25 | 9.71  |
| 104 | 46       | 1020    | 401.8      | 228.3      | 22850 | 11400 | 15080 | 12350 | 7300  | 0.57      | 47.04 | -51.14 | -33.03 | 10.33 | 9.80  |
| 104 | 46       | 1025    | 384.9      | 218.6      | 22330 | 11730 | 15320 | 12780 | 7420  | 0.57      | 47.98 | -49.99 | -31.78 | 10.42 | 9.88  |
| 104 | 46       | 1030    | 441.8      | 237.2      | 23600 | 11800 | 16730 | 13120 | 7710  | 0.54      | 48.89 | -48.78 | -30.53 | 10.50 | 9.96  |
| 104 | 46       | 1035    | 298.8      | 218        | 22380 | 11910 | 13220 | 11680 | 7780  | 0.73      | 49.80 | -47.53 | -29.28 | 10.58 | 10.05 |
| 104 | 46       | 1040    | 417.2      | 237.6      | 22810 | 11990 | 17690 | 12040 | 8150  | 0.57      | 50.68 | -46.22 | -28.03 | 10.67 | 10.13 |
| 104 | 46       | 1045    | 414.4      | 239.4      | 24670 | 12040 | 17110 | 12960 | 8300  | 0.58      | 51.54 | -44.85 | -26.78 | 10.75 | 10.21 |
| 104 | 46       | 1050    | 409.6      | 246.5      | 25390 | 12450 | 18990 | 13610 | 8480  | 0.60      | 52.38 | -43.42 | -25.53 | 10.83 | 10.30 |
| 104 | 46       | 1055    | 323.8      | 232.6      | 23320 | 12310 | 15420 | 11800 | 8580  | 0.72      | 53.20 | -41.94 | -24.28 | 10.92 | 10.38 |
| 104 | 46       | 1100    | 384.7      | 242.9      | 23270 | 11920 | 16360 | 10930 | 8780  | 0.63      | 54.00 | -40.38 | -23.03 | 11.00 | 10.46 |
| 104 | 46       | 1105    | 441.1      | 250.8      | 25020 | 12390 | 14360 | 11050 | 8760  | 0.57      | 54.77 | -38.77 | -21.78 | 11.08 | 10.55 |
| 104 | 46       | 1110    | 327.4      | 220        | 21420 | 10880 | 15290 | 8810  | 8530  | 0.67      | 55.51 | -37.08 | -20.53 | 11.17 | 10.63 |
| 104 | 46       | 1115    | 490.1      | 271.2      | 26000 | 11830 | 16910 | 9610  | 9380  | 0.55      | 56.23 | -35.32 | -19.28 | 11.25 | 10.71 |
| 104 | 46       | 1120    | 305.9      | 225.2      | 21830 | 11310 | 10720 | 6875  | 9300  | 0.74      | 56.91 | -33.50 | -18.03 | 11.33 | 10.80 |
| 104 | 46       | 1125    | 200.6      | 161.9      | 15430 | 9690  | 6543  | 6068  | 7220  | 0.81      | 57.56 | -31.60 | -16.78 | 11.42 | 10.88 |



## AVERAGE RAW DATA FROM STATION

|     | Date     | Time    | Global-R   | Diffuse-R  | Ho    | NE    | NW    | SE    | SW    | SC        | SAIt   | SAzm   | SHr   | Std   | Stime |
|-----|----------|---------|------------|------------|-------|-------|-------|-------|-------|-----------|--------|--------|-------|-------|-------|
|     | (Julian) | (clock) | (watt/sqm) | (watt/sqm) | (Lux) | (Lux) | (Lux) | (Lux) | (Lux) | sky ratio |        |        |       |       |       |
| 104 | 38       | 700     | 10.67      | 7.8        | 525   | 374.9 | 363.3 | 284.5 | 0.73  | 2.58      | -73.02 | -83.00 | 7.00  | 6.47  |       |
| 104 | 38       | 705     | 17.95      | 13.2       | 880   | 627.7 | 620.9 | 474.7 | 0.74  | 3.73      | -72.69 | -81.75 | 7.08  | 6.55  |       |
| 104 | 38       | 710     | 29.36      | 21.02      | 1338  | 901   | 914   | 688.8 | 0.72  | 4.89      | -72.34 | -80.50 | 7.17  | 6.63  |       |
| 104 | 38       | 715     | 34.91      | 25.81      | 1710  | 1159  | 1162  | 896   | 0.73  | 6.04      | -71.99 | -79.25 | 7.25  | 6.72  |       |
| 104 | 38       | 720     | 43.28      | 32.03      | 2136  | 1459  | 1448  | 1118  | 0.74  | 7.19      | -71.83 | -78.00 | 7.33  | 6.80  |       |
| 104 | 38       | 725     | 51.72      | 38.41      | 2570  |       |       | 1344  | 0.74  | 8.33      | -71.26 | -76.75 | 7.42  | 6.88  |       |
| 104 | 38       | 730     | 60.72      | 45.12      | 3040  | 2106  | 2032  | 1594  | 0.74  | 9.48      | -70.88 | -75.50 | 7.50  | 6.97  |       |
| 104 | 38       | 735     | 69.69      | 51.55      | 3464  | 2475  | 2335  | 1508  | 0.74  | 10.62     | -70.50 | -74.25 | 7.58  | 7.05  |       |
| 104 | 38       | 740     | 78.6       | 58.06      | 3897  | 2635  | 2665  | 2132  | 0.74  | 11.76     | -70.10 | -73.00 | 7.67  | 7.13  |       |
| 104 | 38       | 745     | 87.6       | 64.21      | 4299  | 3191  | 2999  | 2412  | 0.73  | 12.89     | -69.69 | -71.75 | 7.75  | 7.22  |       |
| 104 | 38       | 750     | 96.6       | 70         | 4676  | 3548  | 3298  | 2687  | 0.72  | 14.02     | -69.27 | -70.50 | 7.83  | 7.30  |       |
| 104 | 38       | 755     | 106.9      | 75.8       | 5098  | 3876  | 3645  | 2963  | 0.71  | 15.15     | -68.84 | -69.25 | 7.92  | 7.38  |       |
| 104 | 38       | 800     | 119        | 82         | 5663  | 4165  | 4026  | 3231  | 0.69  | 16.28     | -68.40 | -68.00 | 8.00  | 7.47  |       |
| 104 | 38       | 805     | 128.8      | 88.3       | 5973  | 4434  | 4373  | 3472  | 0.69  | 17.40     | -67.95 | -66.75 | 8.08  | 7.55  |       |
| 104 | 38       | 810     | 143.1      | 95         | 6446  | 4726  | 4785  | 3743  | 0.66  | 18.52     | -67.49 | -65.50 | 8.17  | 7.63  |       |
| 104 | 38       | 815     | 153.4      | 100.9      | 6874  | 4998  | 5059  | 3991  | 0.66  | 19.64     | -67.01 | -64.25 | 8.25  | 7.72  |       |
| 104 | 38       | 820     | 160.2      | 105.5      | 7210  | 5243  | 5354  | 4223  | 0.66  | 20.75     | -66.52 | -63.00 | 8.33  | 7.80  |       |
| 104 | 38       | 825     | 173.5      | 109.5      | 7650  | 5508  | 5722  | 4442  | 0.63  | 21.85     | -66.01 | -61.75 | 8.42  | 7.88  |       |
| 104 | 38       | 830     | 179.9      | 111.3      | 7930  | 5626  | 5893  | 4546  | 0.62  | 22.96     | -65.49 | -60.50 | 8.50  | 7.97  |       |
| 104 | 38       | 835     | 189        | 111.6      | 7860  | 5647  | 5805  | 4679  | 0.66  | 24.05     | -64.95 | -59.25 | 8.58  | 8.05  |       |
| 104 | 38       | 840     | 188.5      | 114.9      | 7870  | 5787  | 6010  | 4785  | 0.68  | 25.15     | -64.40 | -58.00 | 8.67  | 8.13  |       |
| 104 | 38       | 845     | 185.1      | 121.5      | 8160  | 6038  | 6599  | 5175  | 0.66  | 26.23     | -63.83 | -56.75 | 8.75  | 8.22  |       |
| 104 | 38       | 850     | 209.1      | 127.8      | 8550  | 6264  | 7160  | 5512  | 0.61  | 27.32     | -63.24 | -55.50 | 8.83  | 8.30  |       |
| 104 | 38       | 855     | 230.8      | 133.9      | 9060  | 6534  | 7560  | 5756  | 0.58  | 28.39     | -62.63 | -54.25 | 8.92  | 8.38  |       |
| 104 | 38       | 900     | 238.9      | 139.5      | 9360  | 6787  | 7910  | 5956  | 0.58  | 29.47     | -62.00 | -53.00 | 9.00  | 8.47  |       |
| 104 | 38       | 905     | 239.4      | 145.4      | 9600  | 7060  | 8170  | 6198  | 0.61  | 30.53     | -61.36 | -51.75 | 9.08  | 8.55  |       |
| 104 | 38       | 910     | 250.1      | 152.6      | 9800  | 7360  | 8670  | 6558  | 0.61  | 31.59     | -60.69 | -50.50 | 9.17  | 8.63  |       |
| 104 | 38       | 915     | 303.6      | 162.3      | 10360 | 7770  | 9610  | 7020  | 0.53  | 32.64     | -59.99 | -49.25 | 9.25  | 8.72  |       |
| 104 | 38       | 920     | 332        | 170.5      | 11080 | 8100  | 10100 | 7180  | 0.51  | 33.68     | -59.28 | -48.00 | 9.33  | 8.80  |       |
| 104 | 38       | 925     | 353.6      | 175.6      | 11550 | 8260  | 10370 | 7220  | 0.50  | 34.72     | -58.54 | -46.75 | 9.42  | 8.88  |       |
| 104 | 38       | 930     | 325.4      | 175.8      | 11620 | 8140  | 10260 | 7120  | 0.54  | 35.74     | -57.77 | -45.50 | 9.50  | 8.97  |       |
| 104 | 38       | 935     | 315.6      | 177.3      | 11590 | 8070  | 10430 | 7280  | 0.56  | 36.76     | -56.98 | -44.25 | 9.58  | 9.05  |       |
| 104 | 38       | 940     | 317.1      | 180.2      | 11710 | 8130  | 10810 | 7560  | 0.57  | 37.77     | -56.15 | -43.00 | 9.67  | 9.13  |       |
| 104 | 38       | 945     | 347.1      | 184.4      | 12030 | 8260  | 11470 | 7920  | 0.53  | 38.77     | -55.30 | -41.75 | 9.75  | 9.22  |       |
| 104 | 38       | 950     | 333.5      | 186        | 12250 | 8170  | 11680 | 8160  | 0.56  | 39.76     | -54.41 | -40.50 | 9.83  | 9.30  |       |
| 104 | 38       | 955     | 334.5      | 189.8      | 12190 | 8180  | 12340 | 8810  | 0.57  | 40.74     | -53.49 | -39.25 | 9.92  | 9.38  |       |
| 104 | 38       | 1000    | 485.3      | 206.7      | 13130 | 9000  | 14660 | 10080 | 0.43  | 41.70     | -52.54 | -38.00 | 10.00 | 9.47  |       |
| 104 | 38       | 1005    | 594.3      | 219.3      | 14550 | 9590  | 15380 | 10400 | 0.37  | 42.66     | -51.55 | -36.75 | 10.08 | 9.55  |       |
| 104 | 38       | 1010    | 472.7      | 215.9      | 14250 | 9320  | 13960 | 9740  | 0.46  | 43.60     | -50.52 | -35.50 | 10.17 | 9.63  |       |
| 104 | 38       | 1015    | 411.9      | 214.4      | 13720 | 9210  | 13280 | 9390  | 0.52  | 44.52     | -49.45 | -34.25 | 10.25 | 9.72  |       |
| 104 | 38       | 1020    | 411.9      | 217        | 13580 | 9230  | 13460 | 9570  | 0.53  | 45.43     | -48.34 | -33.00 | 10.33 | 9.80  |       |
| 104 | 38       | 1025    | 455.6      | 224.5      | 13910 | 9550  | 13670 | 9920  | 0.49  | 46.33     | -47.19 | -31.75 | 10.42 | 9.88  |       |
| 104 | 38       | 1030    | 440.2      | 229        | 13810 | 9700  | 13290 | 9970  | 0.52  | 47.21     | -45.99 | -30.50 | 10.50 | 9.97  |       |
| 104 | 38       | 1035    | 450.1      | 235        | 13760 | 9920  | 13450 | 10180 | 0.52  | 48.07     | -44.74 | -29.25 | 10.58 | 10.05 |       |
| 104 | 38       | 1040    | 448.8      | 241.8      | 13740 | 10140 | 13560 | 10410 | 0.54  | 48.91     | -43.44 | -28.00 | 10.67 | 10.13 |       |
| 104 | 38       | 1045    | 455.3      | 246.8      | 13770 | 10380 | 13770 | 10630 | 0.54  | 49.73     | -42.09 | -26.75 | 10.75 | 10.22 |       |
| 104 | 38       | 1050    | 498.9      | 252.6      | 13970 | 10780 | 14180 | 11050 | 0.51  | 50.53     | -40.69 | -25.50 | 10.83 | 10.30 |       |
| 104 | 38       | 1055    | 512.6      | 254.9      | 14290 | 11060 | 14180 | 11160 | 0.50  | 51.31     | -39.23 | -24.25 | 10.92 | 10.38 |       |
| 104 | 38       | 1100    | 474.2      | 252.6      | 14130 | 11140 | 14100 | 11150 | 0.53  | 52.06     | -37.71 | -23.00 | 11.00 | 10.47 |       |
| 104 | 38       | 1105    | 531        | 252.5      | 14200 | 11350 | 14670 | 11440 | 0.48  | 52.79     | -36.14 | -21.75 | 11.08 | 10.55 |       |
| 104 | 38       | 1110    | 529.7      | 248.8      | 14290 | 11240 | 14800 | 11550 | 0.47  | 53.49     | -34.51 | -20.50 | 11.17 | 10.63 |       |
| 104 | 38       | 1115    | 523.4      | 243.8      | 14220 | 11090 | 14700 | 11520 | 0.47  | 54.16     | -32.82 | -19.25 | 11.25 | 10.72 |       |
| 104 | 38       | 1120    | 481.1      | 239.4      | 13970 | 10750 | 14550 | 11510 | 0.50  | 54.80     | -31.06 | -18.00 | 11.33 | 10.80 |       |
| 104 | 38       | 1125    | 561.7      | 245        | 14060 | 10760 | 15630 | 12500 | 0.44  | 55.40     | -29.25 | -16.75 | 11.42 | 10.88 |       |



## AVERAGE RAW DATA FROM STATION

| Date     | Time    | Global-R   | Diffuse-R  | Ho    | NE    | NW    | SE    | SW    | SC        | SAIt  | SAzm   | SHr    | Std   | Stime |
|----------|---------|------------|------------|-------|-------|-------|-------|-------|-----------|-------|--------|--------|-------|-------|
| (Julian) | (clock) | (watt/sqm) | (watt/sqm) | (Lux) | (Lux) | (Lux) | (Lux) | (Lux) | sky ratio |       |        |        |       |       |
| 104      | 37      | 700        | 16.21      | 11.94 | 781   | 618.8 | 514.8 | 454.5 | 0.74      | 2.51  | -72.73 | -82.98 | 7.00  | 6.47  |
| 104      | 37      | 705        | 17.4       | 13.08 | 966   | 842   | 616.5 | 591.6 | 0.75      | 3.67  | -72.40 | -81.73 | 7.08  | 6.55  |
| 104      | 37      | 710        | 23.96      | 17.88 | 1322  | 1161  | 918   | 830   | 0.75      | 4.82  | -72.05 | -80.48 | 7.17  | 6.63  |
| 104      | 37      | 715        | 38.93      | 27.94 |       | 1293  | 1407  | 1116  | 0.72      | 5.97  | -71.70 | -79.23 | 7.25  | 6.72  |
| 104      | 37      | 720        | 45.27      | 32.01 | 2381  | 1876  | 1646  | 1281  | 0.71      | 7.11  | -71.34 | -77.98 | 7.33  | 6.80  |
| 104      | 37      | 725        | 49.17      | 34.16 | 2663  | 2151  |       | 1530  | 0.70      | 8.26  | -70.97 | -76.73 | 7.42  | 6.88  |
| 104      | 37      | 730        | 69.01      | 43.89 | 3559  | 2565  | 2788  |       | 0.64      | 9.40  | -70.59 | -75.48 | 7.50  | 6.97  |
| 104      | 37      | 735        | 87.1       | 51.38 | 4386  | 2935  | 3613  | 2314  | 0.59      | 10.54 | -70.21 | -74.23 | 7.58  | 7.05  |
| 104      | 37      | 740        | 117.7      | 60.44 | 5242  | 3320  | 4590  | 2763  | 0.51      | 11.67 | -69.81 | -72.98 | 7.67  | 7.13  |
| 104      | 37      | 745        | 139.7      | 62.98 | 5844  | 3553  | 5306  | 3094  | 0.45      | 12.81 | -69.40 | -71.73 | 7.75  | 7.22  |
| 104      | 37      | 750        | 157.1      | 62.63 | 6303  | 3710  | 5910  | 3374  | 0.40      | 13.94 | -68.98 | -70.48 | 7.83  | 7.30  |
| 104      | 37      | 755        | 171.8      | 61.98 | 6772  | 3872  | 6420  | 3613  | 0.36      | 15.07 | -68.55 | -69.23 | 7.92  | 7.38  |
| 104      | 37      | 800        | 191.2      | 62.72 | 7270  | 4032  | 7030  | 3878  | 0.33      | 16.19 | -68.11 | -67.98 | 8.00  | 7.47  |
| 104      | 37      | 805        | 211        | 65.05 | 7770  | 4221  | 7630  | 4147  | 0.31      | 17.31 | -67.66 | -66.73 | 8.08  | 7.55  |
| 104      | 37      | 810        | 230.8      | 68.38 | 8130  | 4378  | 8230  | 4434  | 0.30      | 18.43 | -67.19 | -65.48 | 8.17  | 7.63  |
| 104      | 37      | 815        | 254.1      | 72.1  | 8540  | 4581  | 8790  | 4739  | 0.28      | 19.54 | -66.71 | -64.23 | 8.25  | 7.72  |
| 104      | 37      | 820        | 269.2      | 74.8  | 8790  | 4674  | 9220  | 4976  | 0.28      | 20.65 | -66.22 | -62.98 | 8.33  | 7.80  |
| 104      | 37      | 825        | 285.5      | 78    | 9120  | 4750  | 9700  | 5198  | 0.27      | 21.75 | -65.71 | -61.73 | 8.42  | 7.88  |
| 104      | 37      | 830        | 304.7      | 80.9  | 9430  | 4841  | 10160 | 5404  | 0.27      | 22.85 | -65.19 | -60.48 | 8.50  | 7.97  |
| 104      | 37      | 835        | 325.3      | 83.5  | 9650  | 4943  | 10520 | 5588  | 0.26      | 23.95 | -64.65 | -59.23 | 8.58  | 8.05  |
| 104      | 37      | 840        | 354.9      | 88.1  | 10000 | 5093  | 11070 | 5842  | 0.25      | 25.04 | -64.09 | -57.98 | 8.67  | 8.13  |
| 104      | 37      | 845        | 371.4      | 89.5  | 10190 | 5241  | 11030 | 5942  | 0.24      | 26.12 | -63.52 | -56.73 | 8.75  | 8.22  |
| 104      | 37      | 850        | 346.9      | 86.9  | 9630  | 5204  | 10980 | 5991  | 0.25      | 27.20 | -62.93 | -55.48 | 8.83  | 8.30  |
| 104      | 37      | 855        | 402.8      | 94.1  | 10440 | 5525  | 12120 | 6545  | 0.23      | 28.28 | -62.32 | -54.23 | 8.92  | 8.38  |
| 104      | 37      | 900        | 416.2      | 98.2  | 10820 | 5659  | 12520 | 6741  | 0.24      | 29.34 | -61.69 | -52.98 | 9.00  | 8.47  |
| 104      | 37      | 905        | 428.9      | 100.9 | 10940 | 5732  | 12860 | 6935  | 0.24      | 30.41 | -61.05 | -51.73 | 9.08  | 8.55  |
| 104      | 37      | 910        | 443.1      | 104.2 | 11090 | 5816  | 13350 | 7210  | 0.24      | 31.46 | -60.37 | -50.48 | 9.17  | 8.63  |
| 104      | 37      | 915        | 456.3      | 107.3 | 11220 | 5916  | 13770 | 7480  | 0.24      | 32.51 | -59.68 | -49.23 | 9.25  | 8.72  |
| 104      | 37      | 920        | 476.4      | 111   | 11350 | 6045  | 14200 | 7750  | 0.23      | 33.55 | -58.96 | -47.98 | 9.33  | 8.80  |
| 104      | 37      | 925        | 487.1      | 115.8 | 11540 | 6160  | 14600 | 7960  | 0.24      | 34.58 | -58.22 | -46.73 | 9.42  | 8.88  |
| 104      | 37      | 930        | 505.8      | 120.1 | 11680 | 6292  | 15010 | 8190  | 0.24      | 35.60 | -57.45 | -45.48 | 9.50  | 8.97  |
| 104      | 37      | 935        | 496.1      | 117.6 | 11340 | 6195  | 14380 | 7850  | 0.24      | 36.62 | -56.85 | -44.23 | 9.58  | 9.05  |
| 104      | 37      | 940        | 392.3      | 99.9  | 9580  | 5438  | 12150 | 6849  | 0.25      | 37.62 | -55.83 | -42.98 | 9.67  | 9.13  |
| 104      | 37      | 945        | 464.6      | 107.9 | 9950  | 5743  | 13100 | 7410  | 0.23      | 38.62 | -54.97 | -41.73 | 9.75  | 9.22  |
| 104      | 37      | 950        | 452.3      | 108.9 | 10100 | 5829  | 13510 | 7640  | 0.24      | 39.60 | -54.09 | -40.48 | 9.83  | 9.30  |
| 104      | 37      | 955        | 538        | 123.3 | 11250 | 6171  | 14970 | 8520  | 0.23      | 40.58 | -53.17 | -39.23 | 9.92  | 9.38  |
| 104      | 37      | 1000       | 606.5      | 134.7 | 12030 | 6667  | 16080 | 9240  | 0.22      | 41.54 | -52.21 | -37.98 | 10.00 | 9.47  |
| 104      | 37      | 1005       | 638.8      | 136.9 | 12130 | 6913  | 16050 | 9460  | 0.21      | 42.49 | -51.22 | -36.73 | 10.08 | 9.55  |
| 104      | 37      | 1010       | 627.5      | 136.2 | 11880 | 6973  | 15610 | 9450  | 0.22      | 43.42 | -50.19 | -35.48 | 10.17 | 9.63  |
| 104      | 37      | 1015       | 645.7      | 134.4 | 11560 | 7120  | 15610 | 9630  | 0.21      | 44.35 | -49.12 | -34.23 | 10.25 | 9.72  |
| 104      | 37      | 1020       | 665.1      | 132.6 | 11270 | 7220  | 15550 | 9660  | 0.20      | 45.25 | -48.01 | -32.98 | 10.33 | 9.80  |
| 104      | 37      | 1025       | 713        | 127.9 | 10990 | 7390  | 15380 | 9900  | 0.18      | 46.14 | -46.86 | -31.73 | 10.42 | 9.88  |
| 104      | 37      | 1030       | 741        | 122.1 | 10580 | 7480  | 14980 | 9780  | 0.16      | 47.02 | -45.66 | -30.48 | 10.50 | 9.97  |
| 104      | 37      | 1035       | 749        | 118.9 | 10260 | 7480  | 14820 | 9800  | 0.16      | 47.87 | -44.41 | -29.23 | 10.58 | 10.05 |
| 104      | 37      | 1040       | 755        | 118.4 | 10080 | 7560  | 14670 | 9850  | 0.16      | 48.71 | -43.11 | -27.98 | 10.67 | 10.13 |
| 104      | 37      | 1045       | 771        | 118.7 | 9940  | 7620  | 14630 | 9990  | 0.15      | 49.52 | -41.76 | -26.73 | 10.75 | 10.22 |
| 104      | 37      | 1050       | 788        | 115.2 | 9630  | 7600  | 14320 | 9900  | 0.15      | 50.32 | -40.36 | -25.48 | 10.83 | 10.30 |
| 104      | 37      | 1055       | 806        | 114.5 | 9530  | 7550  | 14380 | 10050 | 0.14      | 51.09 | -38.91 | -24.23 | 10.92 | 10.38 |
| 104      | 37      | 1100       | 813        | 117.1 | 9620  | 7540  | 14490 | 10220 | 0.14      | 51.84 | -37.40 | -22.98 | 11.00 | 10.47 |
| 104      | 37      | 1105       | 827        | 120.4 | 9660  | 7580  | 14730 | 10530 | 0.15      | 52.56 | -35.83 | -21.73 | 11.08 | 10.55 |
| 104      | 37      | 1110       | 843        | 123.9 | 9690  | 7620  | 15020 | 10850 | 0.15      | 53.25 | -34.20 | -20.48 | 11.17 | 10.63 |
| 104      | 37      | 1115       | 853        | 130.1 | 9870  | 7650  | 15310 | 11250 | 0.15      | 53.92 | -32.52 | -19.23 | 11.25 | 10.72 |
| 104      | 37      | 1120       | 852        | 133.6 | 9950  | 7600  | 15260 | 11400 | 0.16      | 54.55 | -30.77 | -17.98 | 11.33 | 10.80 |
| 104      | 37      | 1125       | 847        | 140.3 | 10150 | 7620  | 15030 | 11460 | 0.17      | 55.15 | -28.97 | -16.73 | 11.42 | 10.88 |

## AVERAGE RAW DATA FROM STATION

| Date     | Time    | Global-R   | Diffuse-R  | Ho    | NE    | NW    | SE    | SW    | SC        | SAIt  | SAzm   | SHr    | Std   | Stime |
|----------|---------|------------|------------|-------|-------|-------|-------|-------|-----------|-------|--------|--------|-------|-------|
| (julian) | (clock) | (watt/sqm) | (watt/sqm) | (Lux) | (Lux) | (Lux) | (Lux) | (Lux) | sky ratio |       |        |        |       |       |
| 104      | 43      | 700        | 8.72       | 8.631 | 778   | 413   | 487.2 | 278.3 | 0.76      | 2.98  | -74.52 | -83.04 | 7.00  | 6.46  |
| 104      | 43      | 705        | 12.78      | 9.61  | 1163  | 527.5 | 660.4 | 463.4 | 0.75      | 4.13  | -74.18 | -81.79 | 7.08  | 6.55  |
| 104      | 43      | 710        | 18.33      | 13.59 | 1458  | 910   | 780   | 662   | 0.74      | 5.29  | -73.84 | -80.54 | 7.17  | 6.63  |
| 104      | 43      | 715        | 24.27      | 17.89 | 1850  | 1212  | 890   | 882   | 0.74      | 6.45  | -73.49 | -79.29 | 7.25  | 6.71  |
| 104      | 43      | 720        | 31.04      | 22.55 | 2244  | 1580  | 1117  | 1138  | 0.73      | 7.61  | -73.13 | -78.04 | 7.33  | 6.80  |
| 104      | 43      | 725        | 35.1       | 25.94 | 2308  | 1687  | 1185  | 1087  | 0.74      | 8.76  | -72.78 | -76.79 | 7.42  | 6.88  |
| 104      | 43      | 730        | 45.04      | 32.62 | 3124  | 2041  | 1484  | 1582  | 0.72      | 9.92  | -72.38 | -75.54 | 7.50  | 6.96  |
| 104      | 43      | 735        | 53.05      | 37.6  | 3486  | 2273  |       | 1384  | 0.71      | 11.07 | -72.00 | -74.29 | 7.58  | 7.05  |
| 104      | 43      | 740        | 63.78      | 44.82 | 4298  | 2986  | 1933  | 2490  | 0.70      | 12.22 | -71.60 | -73.04 | 7.67  | 7.13  |
| 104      | 43      | 745        | 77.3       | 51.5  | 4977  | 3697  | 2221  | 2997  | 0.67      | 13.36 | -71.20 | -71.79 | 7.75  | 7.21  |
| 104      | 43      | 750        | 91.5       | 58.34 | 5484  | 4111  | 2453  | 3416  | 0.64      | 14.51 | -70.78 | -70.54 | 7.83  | 7.30  |
| 104      | 43      | 755        | 101.8      | 63.78 | 6241  | 4781  | 2793  | 3973  | 0.63      | 15.65 | -70.36 | -69.29 | 7.92  | 7.38  |
| 104      | 43      | 800        | 121.5      | 70.3  | 7100  | 5587  | 3110  | 4827  | 0.58      | 16.78 | -69.92 | -68.04 | 8.00  | 7.46  |
| 104      | 43      | 805        | 146.1      | 76    | 7920  | 6583  | 3349  | 6005  | 0.52      | 17.92 | -69.48 | -66.79 | 8.08  | 7.55  |
| 104      | 43      | 810        | 158.9      | 81.3  | 8590  | 7090  | 3631  | 6667  | 0.51      | 19.05 | -69.02 | -65.54 | 8.17  | 7.63  |
| 104      | 43      | 815        | 172.4      | 87.2  | 9160  | 7620  | 3855  | 7110  | 0.51      | 20.18 | -68.54 | -64.29 | 8.25  | 7.71  |
| 104      | 43      | 820        | 189.1      | 93    | 9870  | 8130  | 4137  | 7740  | 0.49      | 21.30 | -68.06 | -63.04 | 8.33  | 7.80  |
| 104      | 43      | 825        | 206.5      | 97.5  | 10450 | 8750  | 4349  | 8440  | 0.47      | 22.42 | -67.56 | -61.79 | 8.42  | 7.88  |
| 104      | 43      | 830        | 222        | 101.9 | 11070 | 9160  | 4594  | 9120  | 0.46      | 23.54 | -67.04 | -60.54 | 8.50  | 7.96  |
| 104      | 43      | 835        | 242        | 106.6 | 11730 | 9760  | 4827  | 9860  | 0.44      | 24.65 | -66.51 | -59.29 | 8.58  | 8.05  |
| 104      | 43      | 840        | 254.1      | 110.9 | 12210 | 10130 | 4985  | 10330 | 0.44      | 25.75 | -65.97 | -58.04 | 8.67  | 8.13  |
| 104      | 43      | 845        | 269.8      | 115.2 | 12680 | 10470 | 5159  | 10800 | 0.43      | 26.86 | -65.41 | -56.79 | 8.75  | 8.21  |
| 104      | 43      | 850        | 286.9      | 119.7 | 13260 | 10900 | 5383  | 11390 | 0.42      | 27.95 | -64.82 | -55.54 | 8.83  | 8.30  |
| 104      | 43      | 855        | 304.4      | 124.3 | 13820 | 11320 | 5536  | 12030 | 0.41      | 29.04 | -64.23 | -54.29 | 8.92  | 8.38  |
| 104      | 43      | 900        | 318.3      | 128.6 | 14280 | 11620 | 5694  | 12440 | 0.40      | 30.13 | -63.61 | -53.04 | 9.00  | 8.46  |
| 104      | 43      | 905        | 323.2      | 132.5 | 14640 | 11690 | 5823  | 12590 | 0.41      | 31.21 | -62.97 | -51.79 | 9.08  | 8.55  |
| 104      | 43      | 910        | 337.6      | 136.1 | 15030 | 11870 | 5967  | 12900 | 0.40      | 32.28 | -62.31 | -50.54 | 9.17  | 8.63  |
| 104      | 43      | 915        | 349.9      | 138.9 | 15390 | 12060 | 6103  | 13160 | 0.40      | 33.35 | -61.62 | -49.29 | 9.25  | 8.71  |
| 104      | 43      | 920        | 370.2      | 144.4 | 15890 | 12290 | 6231  | 13620 | 0.39      | 34.41 | -60.92 | -48.04 | 9.33  | 8.80  |
| 104      | 43      | 925        | 379.8      | 148.6 | 16320 | 12360 | 6383  | 13810 | 0.39      | 35.47 | -60.19 | -46.79 | 9.42  | 8.88  |
| 104      | 43      | 930        | 373.2      | 153.7 | 16800 | 12490 | 6510  | 13840 | 0.41      | 36.51 | -59.43 | -45.54 | 9.50  | 8.96  |
| 104      | 43      | 935        | 393.5      | 156   | 17190 | 12680 | 6721  | 14380 | 0.40      | 37.55 | -58.64 | -44.29 | 9.58  | 9.05  |
| 104      | 43      | 940        | 432.5      | 160.3 | 17770 | 13010 | 6957  | 15080 | 0.37      | 38.58 | -57.83 | -43.04 | 9.67  | 9.13  |
| 104      | 43      | 945        | 442.9      | 165.4 | 18330 | 13220 | 7150  | 15470 | 0.37      | 39.59 | -56.98 | -41.79 | 9.75  | 9.21  |
| 104      | 43      | 950        | 458.1      | 169.6 | 18870 | 13430 | 7280  | 15730 | 0.37      | 40.60 | -56.10 | -40.54 | 9.83  | 9.30  |
| 104      | 43      | 955        | 476.2      | 170   | 19010 | 13560 | 7440  | 16180 | 0.36      | 41.60 | -55.19 | -39.29 | 9.92  | 9.38  |
| 104      | 43      | 1000       | 501.6      | 174.5 | 19460 | 13590 | 7710  | 16560 | 0.35      | 42.59 | -54.24 | -38.04 | 10.00 | 9.46  |
| 104      | 43      | 1005       | 516.6      | 178.9 | 20040 | 13830 | 7900  | 17110 | 0.35      | 43.56 | -53.28 | -36.79 | 10.08 | 9.55  |
| 104      | 43      | 1010       | 524.7      | 182.6 | 20500 | 14020 | 8030  | 17560 | 0.35      | 44.53 | -52.23 | -35.54 | 10.17 | 9.63  |
| 104      | 43      | 1015       | 543.8      | 185.6 | 20910 | 14140 | 8180  | 17970 | 0.34      | 45.48 | -51.17 | -34.29 | 10.25 | 9.71  |
| 104      | 43      | 1020       | 560.5      | 186.7 | 21140 | 14190 | 8310  | 18180 | 0.33      | 46.41 | -50.06 | -33.04 | 10.33 | 9.80  |
| 104      | 43      | 1025       | 576.2      | 187.7 | 21290 | 14190 | 8380  | 18610 | 0.33      | 47.33 | -48.90 | -31.79 | 10.42 | 9.88  |
| 104      | 43      | 1030       | 589.2      | 187.6 | 21330 | 14150 | 8510  | 18620 | 0.32      | 48.23 | -47.70 | -30.54 | 10.50 | 9.96  |
| 104      | 43      | 1035       | 611        | 188   | 21420 | 14100 | 8650  | 18700 | 0.31      | 49.12 | -46.45 | -29.29 | 10.58 | 10.05 |
| 104      | 43      | 1040       | 617.8      | 189.8 | 21570 | 13980 | 8670  | 18710 | 0.31      | 49.98 | -45.14 | -28.04 | 10.67 | 10.13 |
| 104      | 43      | 1045       | 635.2      | 190.9 | 21770 | 13890 | 8780  | 18730 | 0.30      | 50.83 | -43.78 | -26.79 | 10.75 | 10.21 |
| 104      | 43      | 1050       | 640.1      | 192.5 | 21880 | 13750 | 8820  | 18700 | 0.30      | 51.66 | -42.36 | -25.54 | 10.83 | 10.30 |
| 104      | 43      | 1055       | 648.9      | 195.3 | 22090 | 13660 | 8940  | 18700 | 0.30      | 52.46 | -40.89 | -24.29 | 10.92 | 10.38 |
| 104      | 43      | 1100       | 658.1      | 197   | 22300 | 13540 | 8990  | 18660 | 0.30      | 53.24 | -39.35 | -23.04 | 11.00 | 10.46 |
| 104      | 43      | 1105       | 662.4      | 199.9 | 22560 | 13450 | 9080  | 18600 | 0.30      | 53.99 | -37.75 | -21.79 | 11.08 | 10.55 |
| 104      | 43      | 1110       | 673.1      | 198.9 | 22450 | 13230 | 9140  | 18470 | 0.30      | 54.72 | -36.09 | -20.54 | 11.17 | 10.63 |
| 104      | 43      | 1115       | 676.1      | 198.7 | 22370 | 13000 | 9140  | 18340 | 0.29      | 55.42 | -34.35 | -19.29 | 11.25 | 10.71 |
| 104      | 43      | 1120       | 689.2      | 198.5 | 22400 | 12860 | 9240  | 18170 | 0.29      | 56.08 | -32.58 | -18.04 | 11.33 | 10.80 |
| 104      | 43      | 1125       | 696.9      | 198   | 22270 | 12690 | 9250  | 18050 | 0.28      | 56.72 | -30.69 | -16.79 | 11.42 | 10.88 |

## AVERAGE RAW DATA FROM STATION

|     | Date     | Time    | Global-R   | Diffuse-R  | Ho    | NE    | NW    | SE    | SW    | SC        | SAIt  | SAzm   | SHr    | Std   | Stime |
|-----|----------|---------|------------|------------|-------|-------|-------|-------|-------|-----------|-------|--------|--------|-------|-------|
|     | (julian) | (clock) | (watt/sqm) | (watt/sqm) | (Lux) | (Lux) | (Lux) | (Lux) | (Lux) | sky ratio |       |        |        |       |       |
| 104 | 36       | 700     | 9.11       | 6.309      |       | 505.8 | 307.2 | 335.1 | 244   | 0.69      | 2.45  | -72.45 | -82.96 | 7.00  | 6.47  |
| 104 | 36       | 705     | 13.77      | 9.64       |       | 741   | 494.7 | 514.2 | 371.6 | 0.70      | 3.60  | -72.11 | -81.71 | 7.08  | 6.55  |
| 104 | 36       | 710     | 19.81      | 13.48      |       | 1063  | 702   | 736   | 532   | 0.68      | 4.75  | -71.77 | -80.46 | 7.17  | 6.64  |
| 104 | 36       | 715     | 26.61      | 17.34      |       | 1398  | 894   | 1003  | 714   | 0.65      | 5.90  | -71.42 | -79.21 | 7.25  | 6.72  |
| 104 | 36       | 720     | 37.9       | 22.75      |       | 1141  | 1155  | 1410  | 958   | 0.60      | 7.04  | -71.06 | -77.96 | 7.33  | 6.80  |
| 104 | 36       | 725     | 43.8       | 25.07      |       | 2125  | 1328  | 1641  | 1127  | 0.57      | 8.19  | -70.69 | -76.71 | 7.42  | 6.89  |
| 104 | 36       | 730     | 51.9       | 28.82      |       | 2504  | 1555  |       | 1353  | 0.56      | 9.33  | -70.31 | -75.46 | 7.50  | 6.97  |
| 104 | 36       | 735     | 64.3       | 34.13      |       | 3033  | 1641  | 2474  | 1646  | 0.53      | 10.46 | -69.92 | -74.21 | 7.58  | 7.05  |
| 104 | 36       | 740     | 81.7       | 40.14      |       | 3677  | 2152  | 3084  |       | 0.49      | 11.60 | -69.52 | -72.96 | 7.67  | 7.14  |
| 104 | 36       | 745     | 95.1       | 44.14      |       | 4165  | 2410  | 3531  | 2203  | 0.46      | 12.73 | -69.11 | -71.71 | 7.75  | 7.22  |
| 104 | 36       | 750     | 105.7      | 47.8       |       | 4596  | 2652  | 3934  | 2451  | 0.45      | 13.86 | -68.69 | -70.46 | 7.83  | 7.30  |
| 104 | 36       | 755     | 123        | 53.29      |       | 5197  | 3020  | 4569  | 2624  | 0.43      | 14.98 | -68.26 | -69.21 | 7.92  | 7.39  |
| 104 | 36       | 800     | 152.3      | 60.86      |       | 6071  | 3426  | 5462  | 3263  | 0.40      | 16.10 | -67.82 | -67.96 | 8.00  | 7.47  |
| 104 | 36       | 805     | 174.9      | 66.77      |       | 6733  | 3709  | 6141  | 3592  | 0.38      | 17.22 | -67.37 | -66.71 | 8.08  | 7.55  |
| 104 | 36       | 810     | 196.9      | 72.5       |       | 7290  | 3983  | 6774  | 3892  | 0.37      | 18.34 | -66.90 | -65.46 | 8.17  | 7.64  |
| 104 | 36       | 815     | 216.7      | 77         |       | 7780  | 4166  | 7330  | 4116  | 0.36      | 19.45 | -66.42 | -64.21 | 8.25  | 7.72  |
| 104 | 36       | 820     | 234.2      | 79.6       |       | 8120  | 4335  | 7740  | 4284  | 0.34      | 20.55 | -65.92 | -62.96 | 8.33  | 7.80  |
| 104 | 36       | 825     | 244.5      | 81.5       |       | 8290  | 4435  | 7980  | 4422  | 0.33      | 21.65 | -65.42 | -61.71 | 8.42  | 7.89  |
| 104 | 36       | 830     | 264.7      | 85.1       |       | 8650  | 4649  | 8440  | 4663  | 0.32      | 22.75 | -64.89 | -60.46 | 8.50  | 7.97  |
| 104 | 36       | 835     | 285.9      | 89.1       |       | 9090  | 4828  | 8970  | 4914  | 0.31      | 23.84 | -64.35 | -59.21 | 8.58  | 8.05  |
| 104 | 36       | 840     | 310.4      | 92.7       |       | 9530  | 5003  | 9530  | 5174  | 0.30      | 24.93 | -63.80 | -57.96 | 8.67  | 8.14  |
| 104 | 36       | 845     | 333.4      | 95.9       |       | 9960  | 5144  | 10060 | 5419  | 0.29      | 26.01 | -63.22 | -56.71 | 8.75  | 8.22  |
| 104 | 36       | 850     | 350        | 98.6       |       | 10360 | 5250  | 10420 | 5604  | 0.28      | 27.09 | -62.63 | -55.46 | 8.83  | 8.30  |
| 104 | 36       | 855     | 360.9      | 100.8      |       | 10900 | 5348  | 10710 | 5776  | 0.28      | 28.16 | -62.02 | -54.21 | 8.92  | 8.39  |
| 104 | 36       | 900     | 381        | 103.2      |       | 11910 | 5479  | 11030 | 5981  | 0.27      | 29.23 | -61.39 | -52.96 | 9.00  | 8.47  |
| 104 | 36       | 905     | 396.6      | 105.2      |       | 13060 | 5587  | 11270 | 6157  | 0.27      | 30.29 | -60.74 | -51.71 | 9.08  | 8.55  |
| 104 | 36       | 910     | 414.2      | 107.7      |       | 14160 | 5671  | 11530 | 6324  | 0.26      | 31.34 | -60.07 | -50.46 | 9.17  | 8.64  |
| 104 | 36       | 915     | 426.6      | 109.2      |       | 14750 | 5754  | 11660 | 6434  | 0.26      | 32.38 | -59.37 | -49.21 | 9.25  | 8.72  |
| 104 | 36       | 920     | 431.4      | 110.1      |       | 14800 | 5822  | 11640 | 6512  | 0.26      | 33.42 | -58.65 | -47.96 | 9.33  | 8.80  |
| 104 | 36       | 925     | 449.5      | 111.5      |       | 14970 | 5892  | 11750 | 6635  | 0.25      | 34.45 | -57.91 | -46.71 | 9.42  | 8.89  |
| 104 | 36       | 930     | 454.6      | 112.8      |       | 14640 | 5924  | 11790 | 6753  | 0.25      | 35.47 | -57.14 | -45.46 | 9.50  | 8.97  |
| 104 | 36       | 935     | 474        | 117.1      |       | 14620 | 6064  | 12150 | 6969  | 0.25      | 36.46 | -56.34 | -44.21 | 9.58  | 9.05  |
| 104 | 36       | 940     | 490.2      | 119.3      |       | 14500 | 6187  | 12230 | 7130  | 0.24      | 37.46 | -55.51 | -42.96 | 9.67  | 9.14  |
| 104 | 36       | 945     | 503.6      | 122.3      |       | 14290 | 6279  | 12420 | 7320  | 0.24      | 38.47 | -54.65 | -41.71 | 9.75  | 9.22  |
| 104 | 36       | 950     | 528.4      | 126.4      |       | 14240 | 6440  | 12670 | 7520  | 0.24      | 39.45 | -53.77 | -40.46 | 9.83  | 9.30  |
| 104 | 36       | 955     | 539.4      | 128.6      |       | 13920 | 6569  | 12770 | 7710  | 0.24      | 40.42 | -52.84 | -39.21 | 9.92  | 9.39  |
| 104 | 36       | 1000    | 557.5      | 129.3      |       | 13770 | 6722  | 12860 | 7890  | 0.23      | 41.38 | -51.89 | -37.96 | 10.00 | 9.47  |
| 104 | 36       | 1005    | 589.4      | 130.5      |       | 12120 | 6703  | 13960 | 8310  | 0.22      | 42.32 | -50.90 | -36.71 | 10.08 | 9.55  |
| 104 | 36       | 1010    | 590.2      | 134.8      |       | 10750 | 6948  | 15270 | 8820  | 0.23      | 43.26 | -49.87 | -35.46 | 10.17 | 9.64  |
| 104 | 36       | 1015    | 600.9      | 138        |       | 10710 | 7100  | 15310 | 9060  | 0.23      | 44.17 | -48.80 | -34.21 | 10.25 | 9.72  |
| 104 | 36       | 1020    | 618.2      | 138        |       | 10650 | 7220  | 15280 | 9270  | 0.22      | 45.07 | -47.68 | -32.96 | 10.33 | 9.80  |
| 104 | 36       | 1025    | 622.4      | 139.5      |       | 10630 | 7310  | 15160 | 9400  | 0.22      | 45.96 | -46.53 | -31.71 | 10.42 | 9.89  |
| 104 | 36       | 1030    | 635.9      | 142.2      |       | 10570 | 7430  | 15140 | 9580  | 0.22      | 46.83 | -45.33 | -30.46 | 10.50 | 9.97  |
| 104 | 36       | 1035    | 656.8      | 143.4      |       | 10540 | 7590  | 15180 | 9830  | 0.22      | 47.68 | -44.08 | -29.21 | 10.58 | 10.05 |
| 104 | 36       | 1040    | 684        | 147.1      |       | 10640 | 7810  | 15190 | 10070 | 0.22      | 48.51 | -42.79 | -27.96 | 10.67 | 10.14 |
| 104 | 36       | 1045    | 680.8      | 150.7      |       | 10530 | 7920  | 15020 | 10180 | 0.22      | 49.32 | -41.44 | -26.71 | 10.75 | 10.22 |
| 104 | 36       | 1050    | 689.9      | 148.6      |       | 10340 | 8030  | 14860 | 10340 | 0.22      | 50.11 | -40.04 | -25.46 | 10.83 | 10.30 |
| 104 | 36       | 1055    | 707        | 145.7      |       | 10060 | 8110  | 14590 | 10380 | 0.21      | 50.88 | -38.59 | -24.21 | 10.92 | 10.39 |
| 104 | 36       | 1100    | 717        | 145.9      |       | 9970  | 8110  | 14520 | 10490 | 0.20      | 51.62 | -37.09 | -22.96 | 11.00 | 10.47 |
| 104 | 36       | 1105    | 711        | 147.3      |       | 9720  | 8090  | 14270 | 10530 | 0.21      | 52.34 | -35.52 | -21.71 | 11.08 | 10.55 |
| 104 | 36       | 1110    | 729        | 144.2      |       | 9560  | 8190  | 14110 | 10560 | 0.20      | 53.02 | -33.90 | -20.46 | 11.17 | 10.64 |
| 104 | 36       | 1115    | 747        | 145.2      |       | 9420  | 8350  | 13950 | 10640 | 0.19      | 53.68 | -32.22 | -19.21 | 11.25 | 10.72 |
| 104 | 36       | 1120    | 765        | 140        |       | 9120  | 8420  | 13440 | 10520 | 0.18      | 54.31 | -30.49 | -17.96 | 11.33 | 10.80 |
| 104 | 36       | 1125    | 773        | 138.2      |       | 9050  | 8620  | 13150 | 10530 | 0.18      | 54.91 | -28.69 | -16.71 | 11.42 | 10.89 |



## AVERAGE RAW DATA FROM STATION

|     | Date     | Time    | Global-R   | Diffuse-R  | Ho    | NE    | NW    | SE    | SW    | SC        | SAIt  | SAzm   | SHr    | Std   | Stime |
|-----|----------|---------|------------|------------|-------|-------|-------|-------|-------|-----------|-------|--------|--------|-------|-------|
|     | (Julian) | (clock) | (watt/sqm) | (watt/sqm) | (Lux) | (Lux) | (Lux) | (Lux) | (Lux) | sky ratio |       |        |        |       |       |
| 104 | 42       | 700     | 4.865      | 3.864      | 422.1 | 652.3 | 247.4 | 1476  |       | 0.79      | 2.88  | -74.21 | -83.04 | 7.00  | 6.46  |
| 104 | 42       | 705     | 7.48       | 5.842      | 616.2 | 732   | 361.4 | 617.5 |       | 0.78      | 4.04  | -73.68 | -81.79 | 7.08  | 6.55  |
| 104 | 42       | 710     | 9.29       | 7.26       | 874   | 368.7 | 521.8 | 341   |       | 0.78      | 5.20  | -73.53 | -80.54 | 7.17  | 6.63  |
| 104 | 42       | 715     | 10.05      | 7.91       | 821   | 496.9 | 612.4 | 224.5 |       | 0.79      | 6.36  | -73.18 | -79.29 | 7.25  | 6.71  |
| 104 | 42       | 720     | 14.32      | 11.22      | 1210  | 682.3 | 803   | 420.6 |       | 0.78      | 7.52  | -72.82 | -78.04 | 7.33  | 6.80  |
| 104 | 42       | 725     | 18.34      | 14.36      | 1191  | 796   | 995   | 546.8 |       | 0.78      | 8.67  | -72.45 | -76.79 | 7.42  | 6.88  |
| 104 | 42       | 730     | 23.87      | 18.78      | 1778  | 1166  | 1208  | 643.5 |       | 0.79      | 9.82  | -72.08 | -75.54 | 7.50  | 6.96  |
| 104 | 42       | 735     | 27.06      | 21.23      | 2082  | 1504  | 1095  | 992   |       | 0.78      | 10.97 | -71.69 | -74.29 | 7.58  | 7.05  |
| 104 | 42       | 740     | 29.56      | 23.14      | 2416  | 1222  | 1501  | 884   |       | 0.78      | 12.12 | -71.30 | -73.04 | 7.67  | 7.13  |
| 104 | 42       | 745     | 36.72      | 30.16      | 2753  | 1788  |       | 957   |       | 0.78      | 13.26 | -70.89 | -71.79 | 7.75  | 7.21  |
| 104 | 42       | 750     | 43.88      | 33.86      | 3202  |       |       | 1123  |       | 0.77      | 14.40 | -70.48 | -70.54 | 7.83  | 7.30  |
| 104 | 42       | 755     | 43.9       | 33.98      | 3207  |       |       | 1284  |       | 0.77      | 15.54 | -70.05 | -69.29 | 7.92  | 7.38  |
| 104 | 42       | 800     | 56.48      | 43.64      | 4243  | 2645  | 2387  | 1716  |       | 0.77      | 16.68 | -69.61 | -68.04 | 8.00  | 7.46  |
| 104 | 42       | 805     | 74.7       | 57.09      | 5409  | 3008  | 2925  | 2152  |       | 0.76      | 17.81 | -69.16 | -66.79 | 8.08  | 7.55  |
| 104 | 42       | 810     | 75.6       | 57.77      | 5598  | 3116  | 2941  | 2323  |       | 0.76      | 18.94 | -68.70 | -65.54 | 8.17  | 7.63  |
| 104 | 42       | 815     | 76.7       | 59.05      | 5602  | 3230  | 3005  | 2287  |       | 0.77      | 20.06 | -68.23 | -64.29 | 8.25  | 7.71  |
| 104 | 42       | 820     | 109.8      | 82.4       | 7350  | 4767  | 3743  | 3670  |       | 0.75      | 21.18 | -67.74 | -63.04 | 8.33  | 7.80  |
| 104 | 42       | 825     | 118        | 89.1       | 8250  | 5529  | 4316  | 4036  |       | 0.76      | 22.30 | -67.24 | -61.79 | 8.42  | 7.88  |
| 104 | 42       | 830     | 119.7      | 91         | 8410  | 5586  | 4245  | 3829  |       | 0.76      | 23.41 | -66.73 | -60.54 | 8.50  | 7.96  |
| 104 | 42       | 835     | 133        | 100.3      | 9210  | 5920  | 4791  | 4161  |       | 0.75      | 24.52 | -66.19 | -59.29 | 8.58  | 8.05  |
| 104 | 42       | 840     | 126.5      | 98.2       | 9070  | 5495  | 5000  | 3519  |       | 0.76      | 25.62 | -65.65 | -58.04 | 8.67  | 8.13  |
| 104 | 42       | 845     | 124.7      | 94.8       | 8720  | 5080  | 4651  | 3805  |       | 0.76      | 26.72 | -65.08 | -56.79 | 8.75  | 8.21  |
| 104 | 42       | 850     | 158.1      | 119.1      | 10880 | 6935  | 5757  | 4861  |       | 0.75      | 27.82 | -64.50 | -55.54 | 8.83  | 8.30  |
| 104 | 42       | 855     | 181.1      | 134.2      | 11980 | 7540  | 5847  | 5604  |       | 0.74      | 28.91 | -63.90 | -54.29 | 8.92  | 8.38  |
| 104 | 42       | 900     | 175        | 135.6      | 12330 | 7920  | 6423  | 5259  |       | 0.77      | 29.99 | -63.28 | -53.04 | 9.00  | 8.46  |
| 104 | 42       | 905     | 195.7      | 146.4      | 13290 | 8720  | 6729  | 5933  |       | 0.75      | 31.07 | -62.64 | -51.79 | 9.08  | 8.55  |
| 104 | 42       | 910     | 180.4      | 132.1      | 12550 | 8470  | 6543  | 5859  |       | 0.73      | 32.14 | -61.98 | -50.54 | 9.17  | 8.63  |
| 104 | 42       | 915     | 258.5      | 171.9      | 15290 | 10480 | 7130  | 9700  |       | 0.66      | 33.20 | -61.29 | -49.29 | 9.25  | 8.71  |
| 104 | 42       | 920     | 301        | 188.1      | 16730 | 12100 | 7700  | 10670 |       | 0.62      | 34.26 | -60.58 | -48.04 | 9.33  | 8.80  |
| 104 | 42       | 925     | 272.8      | 169.2      | 16990 | 11730 | 7890  | 9830  |       | 0.69      | 35.31 | -59.85 | -46.79 | 9.42  | 8.88  |
| 104 | 42       | 930     | 304.4      | 203.6      | 10960 | 12290 | 7940  | 12160 |       | 0.67      | 36.35 | -59.09 | -45.54 | 9.50  | 8.96  |
| 104 | 42       | 935     | 260.3      | 183.8      | 16290 | 11010 | 7670  | 10840 |       | 0.71      | 37.38 | -58.30 | -44.29 | 9.58  | 9.05  |
| 104 | 42       | 940     | 382.5      | 201.9      | 19000 | 12530 | 7620  | 15410 |       | 0.53      | 38.41 | -57.48 | -43.04 | 9.67  | 9.13  |
| 104 | 42       | 945     | 434.5      | 209.5      | 19600 | 14340 | 7660  | 15500 |       | 0.48      | 39.42 | -56.64 | -41.79 | 9.75  | 9.21  |
| 104 | 42       | 950     | 452.4      | 212.3      | 20050 | 14630 | 8000  | 19590 |       | 0.47      | 40.43 | -55.76 | -40.54 | 9.83  | 9.30  |
| 104 | 42       | 955     | 460.8      | 211.1      | 20290 | 14820 | 8410  | 20270 |       | 0.46      | 41.42 | -54.84 | -39.29 | 9.92  | 9.38  |
| 104 | 42       | 1000    | 533.2      | 214.3      | 21100 | 15220 | 8450  | 21420 |       | 0.40      | 42.40 | -53.89 | -38.04 | 10.00 | 9.46  |
| 104 | 42       | 1005    | 543.9      | 218.6      | 21450 | 15300 | 8570  | 21730 |       | 0.40      | 43.37 | -52.91 | -36.79 | 10.08 | 9.55  |
| 104 | 42       | 1010    | 546.8      | 213        | 20950 | 14860 | 8440  | 21660 |       | 0.39      | 44.33 | -51.88 | -35.54 | 10.17 | 9.63  |
| 104 | 42       | 1015    | 563        | 213        | 21280 | 15000 | 8560  | 21760 |       | 0.38      | 45.28 | -50.82 | -34.29 | 10.25 | 9.71  |
| 104 | 42       | 1020    | 588.3      | 215.3      | 21740 | 14930 | 8700  | 21960 |       | 0.37      | 46.21 | -49.71 | -33.04 | 10.33 | 9.80  |
| 104 | 42       | 1025    | 589.2      | 212.4      | 21580 | 14750 | 8640  | 21880 |       | 0.36      | 47.12 | -48.55 | -31.79 | 10.42 | 9.88  |
| 104 | 42       | 1030    | 586.8      | 209.4      | 21250 | 14340 | 8760  | 21460 |       | 0.36      | 48.02 | -47.35 | -30.54 | 10.50 | 9.96  |
| 104 | 42       | 1035    | 600.2      | 212.5      | 21460 | 14340 | 8840  | 21450 |       | 0.35      | 48.90 | -46.10 | -29.29 | 10.58 | 10.05 |
| 104 | 42       | 1040    | 598.5      | 213.9      | 21710 | 14130 | 8620  | 21030 |       | 0.36      | 49.76 | -44.79 | -28.04 | 10.67 | 10.13 |
| 104 | 42       | 1045    | 595.7      | 217.8      | 23120 | 14370 | 8840  | 19930 |       | 0.37      | 50.60 | -43.43 | -26.79 | 10.75 | 10.21 |
| 104 | 42       | 1050    | 608        | 217        | 23150 | 14320 | 8950  | 19620 |       | 0.36      | 51.42 | -42.02 | -25.54 | 10.83 | 10.30 |
| 104 | 42       | 1055    | 608.8      | 213.6      | 22870 | 13980 | 8780  | 19500 |       | 0.35      | 52.22 | -40.55 | -24.29 | 10.92 | 10.38 |
| 104 | 42       | 1100    | 671.7      | 217.3      | 23460 | 14120 | 9040  | 19980 |       | 0.32      | 53.00 | -39.01 | -23.04 | 11.00 | 10.46 |
| 104 | 42       | 1105    | 676.7      | 214.6      | 23440 | 13890 | 9290  | 19570 |       | 0.32      | 53.74 | -37.42 | -21.79 | 11.08 | 10.55 |
| 104 | 42       | 1110    | 718        | 214.5      | 23560 | 13670 | 9380  | 19590 |       | 0.30      | 54.46 | -35.76 | -20.54 | 11.17 | 10.63 |
| 104 | 42       | 1115    | 675.7      | 208.4      | 22800 | 13290 | 9340  | 18920 |       | 0.31      | 55.16 | -34.04 | -19.29 | 11.25 | 10.71 |
| 104 | 42       | 1120    | 715        | 213        | 23350 | 13270 | 9590  | 19170 |       | 0.30      | 55.82 | -32.25 | -18.04 | 11.33 | 10.80 |
| 104 | 42       | 1125    | 706        | 216.4      | 23410 | 13030 | 9820  | 19180 |       | 0.31      | 56.45 | -30.39 | -16.79 | 11.42 | 10.88 |



## AVERAGE RAW DATA FROM STATION

|     | Date     | Time    | Global-R   | Diffuse-R  | Ho    | NE    | NW    | SE    | SW    | SC        | SAIt  | SAzm   | SHr    | Std   | Stime |
|-----|----------|---------|------------|------------|-------|-------|-------|-------|-------|-----------|-------|--------|--------|-------|-------|
|     | (Julian) | (clock) | (watt/sqm) | (watt/sqm) | (Lux) | (Lux) | (Lux) | (Lux) | (Lux) | sky ratio |       |        |        |       |       |
| 104 | 44       | 700     | 5.643      | 4.397      | 489.8 | 576.1 | 253   | 817   |       | 0.78      | 3.05  | -74.83 | -83.04 | 7.00  | 6.46  |
| 104 | 44       | 705     | 9.98       | 7.68       | 760   | 648.8 | 391.8 | 312.6 |       | 0.77      | 4.22  | -74.49 | -81.79 | 7.08  | 6.55  |
| 104 | 44       | 710     | 13.53      | 10.49      | 1110  | 740   | 538.4 | 474.5 |       | 0.78      | 5.38  | -74.15 | -80.54 | 7.17  | 6.63  |
| 104 | 44       | 715     | 18.21      | 14.1       | 1375  | 831   | 740   | 508.2 |       | 0.77      | 6.54  | -73.79 | -79.29 | 7.25  | 6.71  |
| 104 | 44       | 720     | 20.62      | 16.26      | 1571  | 1079  | 870   | 589.3 |       | 0.79      | 7.70  | -73.44 | -78.04 | 7.33  | 6.80  |
| 104 | 44       | 725     | 24.75      | 19.29      | 2091  | 1359  | 1102  | 821   |       | 0.78      | 8.86  | -73.07 | -76.79 | 7.42  | 6.88  |
| 104 | 44       | 730     | 34.53      | 26.25      | 2898  | 1155  | 1414  | 1279  |       | 0.76      | 10.02 | -72.69 | -75.54 | 7.50  | 6.96  |
| 104 | 44       | 735     | 42.9       | 32.36      | 3416  | 2366  |       | 1736  |       | 0.75      | 11.17 | -72.31 | -74.29 | 7.58  | 7.05  |
| 104 | 44       | 740     | 56.89      | 41.16      | 4186  | 2876  | 1993  | 2153  |       | 0.72      | 12.32 | -71.91 | -73.04 | 7.67  | 7.13  |
| 104 | 44       | 745     | 82.2       | 54.86      | 5222  | 4076  | 2301  | 3275  |       | 0.67      | 13.47 | -71.51 | -71.79 | 7.75  | 7.21  |
| 104 | 44       | 750     | 102.7      | 61.66      | 6017  | 4738  | 2628  | 4081  |       | 0.60      | 14.62 | -71.10 | -70.54 | 7.83  | 7.30  |
| 104 | 44       | 755     | 116.4      | 66.01      | 6736  | 5487  | 2970  | 4816  |       | 0.57      | 15.76 | -70.67 | -69.29 | 7.92  | 7.38  |
| 104 | 44       | 800     | 129.5      | 71.8       | 7430  | 6148  | 3239  | 5512  |       | 0.55      | 16.90 | -70.24 | -68.04 | 8.00  | 7.46  |
| 104 | 44       | 805     | 143.7      | 79.5       | 8100  | 6641  | 3545  | 6041  |       | 0.55      | 18.03 | -69.79 | -66.79 | 8.08  | 7.55  |
| 104 | 44       | 810     | 153.4      | 85.2       | 8800  | 7200  | 3830  | 6645  |       | 0.56      | 19.17 | -69.33 | -65.54 | 8.17  | 7.63  |
| 104 | 44       | 815     | 170.8      | 90.1       | 9440  | 7980  | 4067  | 7500  |       | 0.53      | 20.30 | -68.86 | -64.29 | 8.25  | 7.71  |
| 104 | 44       | 820     | 182        | 94.8       | 10010 | 8540  | 4289  | 8030  |       | 0.52      | 21.42 | -68.38 | -63.04 | 8.33  | 7.80  |
| 104 | 44       | 825     | 195.1      | 101.3      | 10630 | 9090  | 4564  | 8630  |       | 0.52      | 22.54 | -67.88 | -61.79 | 8.42  | 7.88  |
| 104 | 44       | 830     | 221.6      | 107.7      | 11470 | 9810  | 4897  | 9630  |       | 0.49      | 23.66 | -67.37 | -60.54 | 8.50  | 7.96  |
| 104 | 44       | 835     | 240.1      | 114.7      | 12170 | 10320 | 5173  | 10330 |       | 0.48      | 24.78 | -66.84 | -59.29 | 8.58  | 8.05  |
| 104 | 44       | 840     | 260.7      | 119.2      | 12820 | 10860 | 5427  | 11080 |       | 0.46      | 25.89 | -66.29 | -58.04 | 8.67  | 8.13  |
| 104 | 44       | 845     | 272.2      | 122.8      | 13340 | 11270 | 5533  | 11710 |       | 0.45      | 26.99 | -65.73 | -56.79 | 8.75  | 8.21  |
| 104 | 44       | 850     | 285.6      | 127.6      | 13820 | 11690 | 5668  | 12260 |       | 0.45      | 28.09 | -65.15 | -55.54 | 8.83  | 8.30  |
| 104 | 44       | 855     | 299.8      | 133.6      | 14440 | 12060 | 5877  | 12770 |       | 0.45      | 29.19 | -64.56 | -54.29 | 8.92  | 8.38  |
| 104 | 44       | 900     | 301        | 138.5      | 14930 | 12340 | 6043  | 13190 |       | 0.46      | 30.27 | -63.94 | -53.04 | 9.00  | 8.46  |
| 104 | 44       | 905     | 329.2      | 144        | 15530 | 12730 | 6222  | 13750 |       | 0.44      | 31.36 | -63.30 | -51.79 | 9.08  | 8.55  |
| 104 | 44       | 910     | 352.2      | 148.2      | 16140 | 13060 | 6475  | 14420 |       | 0.42      | 32.44 | -62.64 | -50.54 | 9.17  | 8.63  |
| 104 | 44       | 915     | 372.3      | 148.6      | 16430 | 13260 | 6571  | 14970 |       | 0.40      | 33.51 | -61.96 | -49.29 | 9.25  | 8.71  |
| 104 | 44       | 920     | 373.2      | 151.7      | 16820 | 13420 | 6727  | 15260 |       | 0.41      | 34.57 | -61.26 | -48.04 | 9.33  | 8.80  |
| 104 | 44       | 925     | 394.3      | 156.9      | 17300 | 13680 | 6845  | 15640 |       | 0.40      | 35.63 | -60.53 | -46.79 | 9.42  | 8.88  |
| 104 | 44       | 930     | 395.1      | 159.8      | 17650 | 13830 | 7050  | 15970 |       | 0.40      | 36.68 | -59.77 | -45.54 | 9.50  | 8.96  |
| 104 | 44       | 935     | 426.7      | 163.2      | 18120 | 14090 | 7250  | 16470 |       | 0.38      | 37.72 | -58.99 | -44.29 | 9.58  | 9.05  |
| 104 | 44       | 940     | 448.5      | 168.6      | 18700 | 14090 | 7430  | 16540 |       | 0.38      | 38.75 | -58.17 | -43.04 | 9.67  | 9.13  |
| 104 | 44       | 945     | 464.8      | 173.8      | 21260 | 14370 | 7620  | 17080 |       | 0.37      | 39.77 | -57.33 | -41.79 | 9.75  | 9.21  |
| 104 | 44       | 950     | 429.3      | 176.7      | 21580 | 14340 | 7710  | 17030 |       | 0.41      | 40.78 | -56.45 | -40.54 | 9.83  | 9.30  |
| 104 | 44       | 955     | 483.6      | 180.5      | 22180 | 14510 | 7880  | 17730 |       | 0.37      | 41.79 | -55.54 | -39.29 | 9.92  | 9.38  |
| 104 | 44       | 1000    | 492.3      | 184.2      | 22710 | 14590 | 8100  | 17800 |       | 0.37      | 42.78 | -54.60 | -38.04 | 10.00 | 9.46  |
| 104 | 44       | 1005    | 469        | 187.5      | 23290 | 14880 | 8190  |       |       | 0.40      | 43.76 | -53.61 | -36.79 | 10.08 | 9.55  |
| 104 | 44       | 1010    | 484.8      | 190.3      | 23620 | 14910 | 8330  | 20750 |       | 0.39      | 44.72 | -52.59 | -35.54 | 10.17 | 9.63  |
| 104 | 44       | 1015    | 498.7      | 194.2      | 24100 | 14940 | 8540  | 21090 |       | 0.39      | 45.68 | -51.52 | -34.29 | 10.25 | 9.71  |
| 104 | 44       | 1020    | 548        | 200.6      | 24820 | 15050 | 8730  | 21490 |       | 0.37      | 46.62 | -50.41 | -33.04 | 10.33 | 9.80  |
| 104 | 44       | 1025    | 561.5      | 203.3      | 25130 | 15040 | 8930  | 21640 |       | 0.36      | 47.54 | -49.26 | -31.79 | 10.42 | 9.88  |
| 104 | 44       | 1030    | 525.9      | 210.1      | 25840 | 15040 | 9100  | 21360 |       | 0.40      | 48.45 | -48.06 | -30.54 | 10.50 | 9.96  |
| 104 | 44       | 1035    | 581.3      | 213.2      | 26280 | 15110 | 9270  | 21830 |       | 0.37      | 49.34 | -46.80 | -29.29 | 10.58 | 10.05 |
| 104 | 44       | 1040    | 577.7      | 218.2      | 26790 | 15060 | 9420  | 21570 |       | 0.38      | 50.21 | -45.49 | -28.04 | 10.67 | 10.13 |
| 104 | 44       | 1045    | 598.5      | 223.7      | 27320 | 15030 | 9600  | 21860 |       | 0.37      | 51.06 | -44.13 | -26.79 | 10.75 | 10.21 |
| 104 | 44       | 1050    | 586.5      | 226.6      | 27500 | 14810 | 9700  | 21740 |       | 0.39      | 51.90 | -42.71 | -25.54 | 10.83 | 10.30 |
| 104 | 44       | 1055    | 600.7      | 234.9      | 28300 | 14930 | 9880  | 21770 |       | 0.39      | 52.70 | -41.23 | -24.29 | 10.92 | 10.38 |
| 104 | 44       | 1100    | 561.3      | 238.1      | 28670 | 14930 | 10060 | 20930 |       | 0.42      | 53.49 | -39.69 | -23.04 | 11.00 | 10.46 |
| 104 | 44       | 1105    | 549.8      | 234.9      | 28630 | 14610 | 10370 | 20400 |       | 0.43      | 54.25 | -38.08 | -21.79 | 11.08 | 10.55 |
| 104 | 44       | 1110    | 644        | 240.7      | 29470 | 14990 | 10690 | 21730 |       | 0.37      | 54.98 | -36.41 | -20.54 | 11.17 | 10.63 |
| 104 | 44       | 1115    | 630.6      | 238.2      | 29020 | 14390 | 10760 | 21210 |       | 0.38      | 55.68 | -34.67 | -19.29 | 11.25 | 10.71 |
| 104 | 44       | 1120    | 652        | 241.7      | 29740 | 14760 | 10990 | 21860 |       | 0.37      | 56.36 | -32.87 | -18.04 | 11.33 | 10.80 |
| 104 | 44       | 1125    | 619.3      | 240.8      | 29730 | 14480 | 10970 | 21640 |       | 0.39      | 57.00 | -30.99 | -16.79 | 11.42 | 10.88 |

## AVERAGE RAW DATA FROM STATION

|     | Date     | Time    | Global-R   | Diffuse-R  | Ho    | N     | S     | E     | W     | SC        | SAlt  | SAzm   | SHr    | Std   | Stime |
|-----|----------|---------|------------|------------|-------|-------|-------|-------|-------|-----------|-------|--------|--------|-------|-------|
|     | (Julien) | (clock) | (watt/sqm) | (watt/sqm) | (Lux) | (Lux) | (Lux) | (Lux) | (Lux) | sky ratio |       |        |        |       |       |
| 104 | 48       | 700     | 12.57      | 9.14       | 819   | 448.4 | 552.4 | 360.1 | 325.3 | 0.73      | 3.45  | -76.09 | -63.00 | 7.00  | 6.47  |
| 104 | 48       | 705     | 16.33      | 11.94      | 1120  | 710   | 590.6 | 634.8 | 458.3 | 0.73      | 4.62  | -75.76 | -61.75 | 7.08  | 6.55  |
| 104 | 48       | 710     | 21.75      | 15.77      | 1565  | 921   | 887   | 873   | 570.4 | 0.73      | 5.79  | -75.41 | -60.50 | 7.17  | 6.63  |
| 104 | 48       | 715     | 29.11      | 20.99      | 2121  | 1142  | 1293  | 1194  | 657.1 | 0.72      | 6.96  | -75.06 | -79.25 | 7.25  | 6.72  |
| 104 | 48       | 720     | 38.43      | 26.94      | 2557  | 1386  | 1735  | 1426  | 878   | 0.70      | 8.13  | -74.70 | -78.00 | 7.33  | 6.80  |
| 104 | 48       | 725     | 51.07      | 33.78      | 3133  | 1807  |       |       | 1109  | 0.66      | 9.29  | -74.34 | -76.75 | 7.42  | 6.88  |
| 104 | 48       | 730     | 62.1       | 39.23      | 3615  | 2025  | 2432  | 2335  | 1215  | 0.63      | 10.46 | -73.96 | -75.50 | 7.50  | 6.97  |
| 104 | 48       | 735     | 69.83      | 42.88      | 4057  | 2262  | 2726  | 2688  | 1333  | 0.61      | 11.62 | -73.58 | -74.25 | 7.58  | 7.05  |
| 104 | 48       | 740     | 79.6       | 47.77      | 4604  | 2584  | 3212  | 3146  | 1521  | 0.60      | 12.78 | -73.19 | -73.00 | 7.67  | 7.13  |
| 104 | 48       | 745     | 93.5       | 52.75      | 5103  | 2836  | 3802  | 3595  | 1885  | 0.56      | 13.93 | -72.79 | -71.75 | 7.75  | 7.22  |
| 104 | 48       | 750     | 105.1      | 58.29      | 5739  | 3196  | 4275  | 4107  |       | 0.55      | 15.09 | -72.38 | -70.50 | 7.83  | 7.30  |
| 104 | 48       | 755     | 118.2      | 63.8       | 6361  | 3523  | 4760  | 4632  | 2044  | 0.54      | 16.24 | -71.96 | -69.25 | 7.92  | 7.38  |
| 104 | 48       | 800     | 127.6      | 67.94      | 6967  | 3791  | 5015  | 5158  | 2058  | 0.53      | 17.39 | -71.53 | -68.00 | 8.00  | 7.47  |
| 104 | 48       | 805     | 134.8      | 71.2       | 7280  | 4071  | 5446  | 5389  | 2328  | 0.53      | 18.53 | -71.08 | -66.75 | 8.08  | 7.55  |
| 104 | 48       | 810     | 148.8      | 76.5       | 7960  | 4347  | 6120  | 5945  | 2479  | 0.51      | 19.67 | -70.63 | -65.50 | 8.17  | 7.63  |
| 104 | 48       | 815     | 171.1      | 82.2       | 8560  | 4703  | 6837  | 6623  | 2716  | 0.48      | 20.81 | -70.16 | -64.25 | 8.25  | 7.72  |
| 104 | 48       | 820     | 190        | 87.3       | 9020  | 4938  | 7600  | 7060  | 2944  | 0.46      | 21.95 | -69.68 | -63.00 | 8.33  | 7.80  |
| 104 | 48       | 825     | 204.5      | 92.7       | 9720  | 5286  | 8030  | 7700  | 3082  | 0.45      | 23.08 | -69.19 | -61.75 | 8.42  | 7.88  |
| 104 | 48       | 830     | 224.1      | 99.6       | 10530 | 5672  | 8550  | 8300  | 3263  | 0.44      | 24.21 | -68.69 | -60.50 | 8.50  | 7.97  |
| 104 | 48       | 835     | 242        | 104.4      | 11200 | 5988  | 9130  | 8870  | 3375  | 0.43      | 25.33 | -68.16 | -59.25 | 8.58  | 8.05  |
| 104 | 48       | 840     | 259.7      | 108.8      | 11680 | 6282  | 9670  | 9320  | 3566  | 0.42      | 26.45 | -67.63 | -58.00 | 8.67  | 8.13  |
| 104 | 48       | 845     | 277        | 113.2      | 12190 | 6481  | 10330 | 9690  | 3693  | 0.41      | 27.57 | -67.07 | -56.75 | 8.75  | 8.22  |
| 104 | 48       | 850     | 299        | 118.4      | 12670 | 6754  | 11040 | 10020 | 3926  | 0.40      | 28.68 | -66.50 | -55.50 | 8.83  | 8.30  |
| 104 | 48       | 855     | 318.4      | 123.5      | 13220 | 7010  | 11640 | 10470 | 4103  | 0.39      | 29.79 | -65.91 | -54.25 | 8.92  | 8.38  |
| 104 | 48       | 900     | 345        | 128.2      | 13860 | 7260  | 12310 | 11040 | 4184  | 0.37      | 30.89 | -65.30 | -53.00 | 9.00  | 8.47  |
| 104 | 48       | 905     | 358.9      | 131.8      | 14200 | 7420  | 12700 | 11230 | 4326  | 0.37      | 31.98 | -64.67 | -51.75 | 9.08  | 8.55  |
| 104 | 48       | 910     | 370.6      | 135.2      | 14610 | 7620  | 13100 | 11560 | 4453  | 0.36      | 33.07 | -64.02 | -50.50 | 9.17  | 8.63  |
| 104 | 48       | 915     | 386.7      | 139.3      | 14960 | 7780  | 13660 | 11740 | 4607  | 0.36      | 34.16 | -63.35 | -49.25 | 9.25  | 8.72  |
| 104 | 48       | 920     | 404.6      | 144.5      | 15500 | 7900  | 14210 | 12030 | 4694  | 0.36      | 35.24 | -62.66 | -48.00 | 9.33  | 8.80  |
| 104 | 48       | 925     | 423        | 147.8      | 15720 | 8110  | 14540 | 12220 | 4866  | 0.35      | 36.31 | -61.93 | -46.75 | 9.42  | 8.88  |
| 104 | 48       | 930     | 435.7      | 152.4      | 16320 | 8250  | 14990 | 12400 | 4974  | 0.35      | 37.37 | -61.18 | -45.50 | 9.50  | 8.97  |
| 104 | 48       | 935     | 447.5      | 153.9      | 16500 | 8340  | 15280 | 12650 | 5043  | 0.34      | 38.43 | -60.41 | -44.25 | 9.58  | 9.05  |
| 104 | 48       | 940     | 449.3      | 155        | 16610 | 8380  | 15560 | 12540 | 5085  | 0.34      | 39.47 | -59.60 | -43.00 | 9.67  | 9.13  |
| 104 | 48       | 945     | 464.1      | 159.8      | 17160 | 8550  | 15830 | 12700 | 5272  | 0.34      | 40.51 | -58.77 | -41.75 | 9.75  | 9.22  |
| 104 | 48       | 950     | 486.9      | 163.1      | 17500 | 8750  | 16200 | 12750 | 5434  | 0.33      | 41.54 | -57.90 | -40.50 | 9.83  | 9.30  |
| 104 | 48       | 955     | 507.7      | 165.8      | 17930 | 8940  | 16550 | 12830 | 5568  | 0.33      | 42.56 | -56.99 | -39.25 | 9.92  | 9.38  |
| 104 | 48       | 1000    | 522.1      | 167.4      | 18060 | 9060  | 16870 | 12990 | 5640  | 0.32      | 43.57 | -56.05 | -38.00 | 10.00 | 9.47  |
| 104 | 48       | 1005    | 534.9      | 168.8      | 18170 | 9040  | 17300 | 12790 | 5740  | 0.32      | 44.57 | -55.07 | -36.75 | 10.08 | 9.55  |
| 104 | 48       | 1010    | 571        | 174.6      |       | 9190  | 17950 | 13030 | 5925  | 0.31      | 45.55 | -54.06 | -35.50 | 10.17 | 9.63  |
| 104 | 48       | 1015    | 574.2      | 177.4      | 18940 | 9280  | 18130 | 13110 | 6012  | 0.31      | 46.52 | -52.99 | -34.25 | 10.25 | 9.72  |
| 104 | 48       | 1020    | 570        | 180        | 19210 | 9350  | 18110 | 13120 | 6086  | 0.32      | 47.48 | -51.89 | -33.00 | 10.33 | 9.80  |
| 104 | 48       | 1025    | 602        | 183.7      | 19660 | 9490  | 18570 | 13140 | 6278  | 0.31      | 48.43 | -50.73 | -31.75 | 10.42 | 9.88  |
| 104 | 48       | 1030    | 614.9      | 185.9      | 19870 | 9670  | 18670 | 13090 | 6412  | 0.30      | 49.35 | -49.53 | -30.50 | 10.50 | 9.97  |
| 104 | 48       | 1035    | 640.4      | 192.8      | 20530 | 9920  | 19010 | 13160 | 6684  | 0.30      | 50.27 | -48.27 | -29.25 | 10.58 | 10.05 |
| 104 | 48       | 1040    | 630.3      | 198.1      | 20840 | 10000 | 18730 | 12950 | 6813  | 0.31      | 51.16 | -46.96 | -28.00 | 10.67 | 10.13 |
| 104 | 48       | 1045    | 645.9      | 201.6      | 21140 | 10170 | 19000 | 12760 | 6921  | 0.31      | 52.03 | -45.59 | -26.75 | 10.75 | 10.22 |
| 104 | 48       | 1050    | 626.4      | 212.9      | 22190 | 9420  | 20000 | 12180 | 6454  | 0.34      | 52.89 | -44.15 | -25.50 | 10.83 | 10.30 |
| 104 | 48       | 1055    | 489        | 209        | 20600 | 10790 | 19010 | 11640 | 7090  | 0.43      | 53.72 | -42.66 | -24.25 | 10.92 | 10.38 |
| 104 | 48       | 1100    | 627.3      | 216.9      | 21360 | 11210 | 20300 | 11870 | 8080  | 0.35      | 54.52 | -41.10 | -23.00 | 11.00 | 10.47 |
| 104 | 48       | 1105    | 482.3      | 221.5      | 21850 | 11220 | 21470 | 12430 | 8070  | 0.46      | 55.31 | -39.47 | -21.75 | 11.08 | 10.55 |
| 104 | 48       | 1110    | 410.6      | 234.1      | 22750 | 11710 |       | 12610 | 8030  | 0.57      | 56.06 | -37.77 | -20.50 | 11.17 | 10.63 |
| 104 | 48       | 1115    | 312.3      | 218.9      | 22100 | 11820 | 20080 | 12790 | 7640  | 0.70      | 56.79 | -35.99 | -19.25 | 11.25 | 10.72 |
| 104 | 48       | 1120    | 391.9      | 248.6      | 24570 | 12630 | 22860 | 13460 | 8130  | 0.63      | 57.48 | -34.14 | -18.00 | 11.33 | 10.80 |
| 104 | 48       | 1125    | 715        | 268        | 26130 | 13160 | 23400 | 13910 | 9090  | 0.37      | 58.14 | -32.22 | -16.75 | 11.42 | 10.88 |

## AVERAGE RAW DATA FROM STATION

|     | Date     | Time    | Global-R    | Diffuse-R   | Ho    | N     | S     | E     | W     | SC        | SAIt  | SAzm   | SHr    | Std   | Stime |
|-----|----------|---------|-------------|-------------|-------|-------|-------|-------|-------|-----------|-------|--------|--------|-------|-------|
|     | (julian) | (clock) | (watt/acqm) | (watt/acqm) | (Lux) | (Lux) | (Lux) | (Lux) | (Lux) | sky ratio |       |        |        |       |       |
| 104 | 49       | 700     | 13.72       | 10.14       | 1085  | 703   | 637.9 | 603.6 | 488.4 | 0.74      | 3.55  | -76.42 | -82.99 | 7.00  | 6.47  |
| 104 | 49       | 705     | 19.89       | 14.56       | 1603  | 863   | 1018  | 897   | 471.8 | 0.73      | 4.73  | -76.08 | -81.74 | 7.08  | 6.55  |
| 104 | 49       | 710     | 27.45       | 19.52       |       | 1144  | 1313  | 1223  | 638.1 | 0.71      | 5.90  | -75.74 | -80.49 | 7.17  | 6.63  |
| 104 | 49       | 715     | 35.73       | 24.52       | 2456  | 1502  | 1591  | 1582  | 903   | 0.69      | 7.07  | -75.38 | -79.24 | 7.25  | 6.72  |
| 104 | 49       | 720     | 44.04       | 29.54       | 2917  | 1487  |       | 1843  | 1179  | 0.67      | 8.24  | -75.03 | -77.99 | 7.33  | 6.80  |
| 104 | 49       | 725     | 51.1        | 34.08       | 3448  | 2168  | 2352  | 2327  | 1334  | 0.67      | 9.41  | -74.66 | -76.74 | 7.42  | 6.88  |
| 104 | 49       | 730     | 59.79       | 38.99       | 4027  | 2341  | 2834  | 2679  | 1348  | 0.65      | 10.57 | -74.29 | -75.49 | 7.50  | 6.97  |
| 104 | 49       | 735     | 72.3        | 43.78       | 4406  | 2719  | 3336  | 3108  | 1685  | 0.61      | 11.74 | -73.91 | -74.24 | 7.58  | 7.05  |
| 104 | 49       | 740     | 89.7        | 50.41       | 5228  | 3027  | 4024  | 3876  | 1506  | 0.56      | 12.90 | -73.51 | -72.99 | 7.67  | 7.13  |
| 104 | 49       | 745     | 108.1       | 56.9        | 5834  | 3506  | 4584  | 4833  |       | 0.53      | 14.06 | -73.11 | -71.74 | 7.75  | 7.22  |
| 104 | 49       | 750     | 120.9       | 62.65       | 6474  | 3872  | 5178  | 5266  | 2151  | 0.52      | 15.21 | -72.71 | -70.49 | 7.83  | 7.30  |
| 104 | 49       | 755     | 130.7       | 67.65       | 7210  | 4111  | 5745  | 5803  | 2127  | 0.52      | 16.37 | -72.29 | -69.24 | 7.92  | 7.38  |
| 104 | 49       | 800     | 147.5       | 74.3        | 7800  | 4451  | 6603  | 6267  | 2420  | 0.50      | 17.52 | -71.86 | -67.99 | 8.00  | 7.47  |
| 104 | 49       | 805     | 161.9       | 79.6        | 8220  | 4847  | 7120  | 6882  | 2716  | 0.49      | 18.66 | -71.42 | -66.74 | 8.08  | 7.55  |
| 104 | 49       | 810     | 179.3       | 85.4        | 8930  | 5094  | 7740  | 7490  | 2789  | 0.48      | 19.81 | -70.96 | -65.49 | 8.17  | 7.63  |
| 104 | 49       | 815     | 196.2       | 91.1        | 9540  | 5460  | 8330  | 8020  | 3010  | 0.46      | 20.95 | -70.50 | -64.24 | 8.25  | 7.72  |
| 104 | 49       | 820     | 206.1       | 95.1        | 10010 | 5673  | 8990  | 8450  | 3102  | 0.46      | 22.09 | -70.02 | -62.99 | 8.33  | 7.80  |
| 104 | 49       | 825     | 226.6       | 101         | 10500 | 6081  | 9890  | 9110  | 3385  | 0.45      | 23.22 | -69.53 | -61.74 | 8.42  | 7.88  |
| 104 | 49       | 830     | 248.2       | 107.6       | 11270 | 6257  | 11950 | 9670  | 3469  | 0.43      | 24.35 | -69.02 | -60.49 | 8.50  | 7.97  |
| 104 | 49       | 835     | 265.7       | 113.1       | 11830 | 6544  | 12660 | 10150 | 3625  | 0.43      | 25.48 | -68.50 | -59.24 | 8.58  | 8.05  |
| 104 | 49       | 840     | 282.3       | 120.2       | 12510 | 6749  | 12930 | 10450 | 3763  | 0.43      | 26.60 | -67.97 | -57.99 | 8.67  | 8.13  |
| 104 | 49       | 845     | 289.2       | 126.1       | 12840 | 6994  | 12450 | 10710 | 3899  | 0.43      | 27.72 | -67.42 | -56.74 | 8.75  | 8.22  |
| 104 | 49       | 850     | 278.1       | 128.6       | 12840 | 7220  | 11730 | 10580 | 4120  | 0.46      | 28.84 | -66.85 | -55.49 | 8.83  | 8.30  |
| 104 | 49       | 855     | 292         | 135.2       | 13400 | 7170  | 12330 | 10630 | 4149  | 0.46      | 29.95 | -66.26 | -54.24 | 8.92  | 8.38  |
| 104 | 49       | 900     | 296.1       | 137.9       | 13670 | 7310  | 12010 | 10710 | 4229  | 0.47      | 31.05 | -65.65 | -52.99 | 9.00  | 8.47  |
| 104 | 49       | 905     | 250.2       | 132.6       | 13230 | 7260  | 10410 | 9860  | 4195  | 0.53      | 32.15 | -65.02 | -51.74 | 9.08  | 8.55  |
| 104 | 49       | 910     | 238.9       | 139.4       | 13360 | 7220  | 10910 | 9310  | 4412  | 0.58      | 33.24 | -64.38 | -50.49 | 9.17  | 8.63  |
| 104 | 49       | 915     | 352.4       | 160.8       | 14840 | 7650  | 11110 | 9940  | 4748  | 0.46      | 34.33 | -63.71 | -49.24 | 9.25  | 8.72  |
| 104 | 49       | 920     | 360.7       | 154.8       | 14640 | 8000  | 9880  | 9540  | 4873  | 0.43      | 35.41 | -63.01 | -47.99 | 9.33  | 8.80  |
| 104 | 49       | 925     | 163.4       | 116.4       | 12200 | 7250  | 6636  | 6501  | 4527  | 0.71      | 36.48 | -62.29 | -46.74 | 9.42  | 8.88  |
| 104 | 49       | 930     | 141.6       | 105.9       | 10520 | 6035  | 6071  | 4335  | 3987  | 0.75      | 37.55 | -61.55 | -45.49 | 9.50  | 8.97  |
| 104 | 49       | 935     | 129.7       | 99.4        | 9710  | 6041  | 5741  | 3744  | 3644  | 0.77      | 38.61 | -60.77 | -44.24 | 9.58  | 9.05  |
| 104 | 49       | 940     | 147.6       | 115.7       | 10870 | 5904  | 7290  | 3548  | 4172  | 0.78      | 39.66 | -59.97 | -42.99 | 9.67  | 9.13  |
| 104 | 49       | 945     | 163.8       | 122.7       | 11220 | 5890  | 9240  | 4450  | 4590  | 0.75      | 40.70 | -59.14 | -41.74 | 9.75  | 9.22  |
| 104 | 49       | 950     | 209.9       | 158.7       | 14350 | 6911  | 12320 | 6282  | 5593  | 0.76      | 41.74 | -58.27 | -40.49 | 9.83  | 9.30  |
| 104 | 49       | 955     | 270.7       | 176.7       | 15720 | 7680  | 11610 | 7950  | 5724  | 0.65      | 42.76 | -57.37 | -39.24 | 9.92  | 9.38  |
| 104 | 49       | 1000    | 258.9       | 185         | 16970 | 8750  | 9710  | 9190  | 5740  | 0.71      | 43.77 | -56.43 | -37.99 | 10.00 | 9.47  |
| 104 | 49       | 1005    | 374.9       | 223.7       | 19950 | 10410 | 13600 | 11550 | 6663  | 0.60      | 44.78 | -55.45 | -36.74 | 10.08 | 9.55  |
| 104 | 49       | 1010    | 376.1       | 241.8       | 21770 | 11100 | 13780 | 10380 | 7740  | 0.64      | 45.77 | -54.43 | -35.49 | 10.17 | 9.63  |
| 104 | 49       | 1015    | 335.1       | 248.1       | 22460 | 12080 | 12370 | 9520  | 7930  | 0.74      | 46.74 | -63.37 | -34.24 | 10.25 | 9.72  |
| 104 | 49       | 1020    | 391.6       | 229         | 20440 | 10780 | 12060 | 8020  | 8090  | 0.58      | 47.71 | -52.27 | -32.99 | 10.33 | 9.80  |
| 104 | 49       | 1025    | 276.9       | 212.8       |       | 10730 | 10890 | 8220  | 7540  | 0.77      | 48.66 | -51.11 | -31.74 | 10.42 | 9.88  |
| 104 | 49       | 1030    | 334.2       | 218.6       |       | 9910  | 14630 | 8520  | 7620  | 0.65      | 49.59 | -49.91 | -30.49 | 10.50 | 9.97  |
| 104 | 49       | 1035    | 375.1       | 274.9       | 25750 | 12490 | 17630 | 11250 | 8720  | 0.73      | 50.51 | -48.85 | -29.24 | 10.58 | 10.05 |
| 104 | 49       | 1040    | 350.6       | 223.8       | 21230 | 11280 | 15720 | 9250  | 8100  | 0.64      | 51.40 | -47.33 | -27.99 | 10.67 | 10.13 |
| 104 | 49       | 1045    | 310         | 225.1       | 21590 | 11130 | 12970 | 9500  | 7920  | 0.73      | 52.28 | -45.96 | -26.74 | 10.75 | 10.22 |
| 104 | 49       | 1050    | 297.8       | 180.3       | 16640 | 10280 | 10340 | 7450  | 6919  | 0.61      | 53.14 | -44.53 | -25.49 | 10.83 | 10.30 |
| 104 | 49       | 1055    | 198.8       | 153.7       | 14940 | 8880  | 6689  | 6119  | 5988  | 0.77      | 53.98 | -43.03 | -24.24 | 10.92 | 10.38 |
| 104 | 49       | 1100    | 246.4       | 193         |       | 9700  | 10320 | 7450  | 6327  | 0.78      | 54.79 | -41.46 | -22.99 | 11.00 | 10.47 |
| 104 | 49       | 1105    | 309         | 228.6       | 21200 | 10820 | 11030 | 8220  | 7560  | 0.74      | 55.58 | -39.82 | -21.74 | 11.08 | 10.55 |
| 104 | 49       | 1110    | 311.7       | 243.5       | 22390 | 11550 | 12540 | 9380  | 8030  | 0.78      | 56.34 | -38.12 | -20.49 | 11.17 | 10.63 |
| 104 | 49       | 1115    | 345         | 259         | 23390 | 12160 | 13170 | 9390  | 8580  | 0.75      | 57.07 | -36.33 | -19.24 | 11.25 | 10.72 |
| 104 | 49       | 1120    | 354         | 266.4       | 24290 | 12570 | 13400 | 9830  | 8880  | 0.75      | 57.77 | -34.47 | -17.99 | 11.33 | 10.80 |
| 104 | 49       | 1125    | 396.2       | 284.8       | 25850 | 13440 | 15040 | 10170 | 9640  | 0.72      | 58.44 | -32.54 | -16.74 | 11.42 | 10.88 |



## AVERAGE RAW DATA FROM STATION

|     | Date     | Time    | Global-R   | Diffuse-R  | Ho    | N     | S     | E     | W     | SC        | SAIt  | SAzm   | SHr    | Std   | Stime |
|-----|----------|---------|------------|------------|-------|-------|-------|-------|-------|-----------|-------|--------|--------|-------|-------|
|     | (julian) | (clock) | (watt/sqm) | (watt/sqm) | (Lux) | (Lux) | (Lux) | (Lux) | (Lux) | sky ratio |       |        |        |       |       |
| 104 | 50       | 700     | 15.07      | 10.84      | 1306  | 885   | 874   | 937   | 511.7 | 0.72      | 3.67  | -76.74 | -82.97 | 7.00  | 6.47  |
| 104 | 50       | 705     | 19.36      | 13.84      | 1584  | 1196  | 1170  | 1129  | 767   | 0.71      | 4.84  | -76.41 | -81.72 | 7.08  | 6.55  |
| 104 | 50       | 710     | 24.47      | 17.12      | 2068  | 1380  | 1513  | 1543  | 778   | 0.70      | 6.02  | -76.06 | -80.47 | 7.17  | 6.64  |
| 104 | 50       | 715     | 30.71      | 21.26      | 2484  | 1442  | 1099  | 2058  | 1058  | 0.69      | 7.19  | -75.71 | -79.22 | 7.25  | 6.72  |
| 104 | 50       | 720     | 41.42      | 27.19      | 3032  | 2192  | 2477  | 2670  | 1296  | 0.66      | 8.36  | -75.35 | -77.97 | 7.33  | 6.80  |
| 104 | 50       | 725     | 62.28      | 36.08      | 3773  | 2634  | 3590  | 3595  | 1576  | 0.58      | 9.53  | -74.99 | -76.72 | 7.42  | 6.89  |
| 104 | 50       | 730     | 89.9       | 45.2       | 4528  | 3118  | 4557  | 4663  |       | 0.50      | 10.70 | -74.61 | -75.47 | 7.50  | 6.97  |
| 104 | 50       | 735     | 107.6      | 51.13      | 5251  | 3416  | 5508  | 5412  | 2019  | 0.48      | 11.86 | -74.23 | -74.22 | 7.58  | 7.05  |
| 104 | 50       | 740     | 125.5      | 55.83      | 5642  | 3906  | 6229  | 5999  | 2468  | 0.44      | 13.02 | -73.84 | -72.97 | 7.67  | 7.14  |
| 104 | 50       | 745     | 147.8      | 60.92      | 6492  | 4155  | 7160  | 6797  | 2538  | 0.41      | 14.18 | -73.44 | -71.72 | 7.75  | 7.22  |
| 104 | 50       | 750     | 175.4      | 65.65      | 7150  | 4562  | 7900  | 7410  | 2626  | 0.37      | 15.34 | -73.04 | -70.47 | 7.83  | 7.30  |
| 104 | 50       | 755     | 187        | 67.58      | 7490  | 4711  | 8190  | 7540  | 2912  | 0.38      | 16.50 | -72.62 | -69.22 | 7.92  | 7.39  |
| 104 | 50       | 800     | 195        | 69.62      | 7460  | 4840  | 8570  | 7540  | 3060  | 0.36      | 17.65 | -72.19 | -67.97 | 8.00  | 7.47  |
| 104 | 50       | 805     | 209.6      | 75.4       | 7750  | 5028  | 9410  | 8020  | 3224  | 0.36      | 18.80 | -71.75 | -66.72 | 8.08  | 7.55  |
| 104 | 50       | 810     | 237.5      | 83         | 8410  | 5288  | 10480 | 8890  | 3369  | 0.35      | 19.95 | -71.30 | -65.47 | 8.17  | 7.64  |
| 104 | 50       | 815     | 272.2      | 90.7       | 9130  | 5668  | 11470 | 9700  | 3571  | 0.33      | 21.09 | -70.83 | -64.22 | 8.25  | 7.72  |
| 104 | 50       | 820     | 299        | 98.6       | 9790  | 6015  | 12450 | 10250 | 3629  | 0.33      | 22.23 | -70.36 | -62.97 | 8.33  | 7.80  |
| 104 | 50       | 825     | 325.9      | 107.3      | 10810 | 6393  | 13840 | 11000 | 3642  | 0.33      | 23.37 | -69.87 | -61.72 | 8.42  | 7.89  |
| 104 | 50       | 830     | 314.6      | 112.4      | 11180 | 6589  | 15120 | 11080 | 3650  | 0.36      | 24.50 | -69.36 | -60.47 | 8.50  | 7.97  |
| 104 | 50       | 835     | 312.6      | 117        | 11470 | 6748  | 14840 | 11480 | 4063  | 0.37      | 25.63 | -68.85 | -59.22 | 8.58  | 8.05  |
| 104 | 50       | 840     | 332.6      | 117.5      | 11470 | 6766  | 14350 | 11250 | 4089  | 0.35      | 26.76 | -68.31 | -57.97 | 8.67  | 8.14  |
| 104 | 50       | 845     | 311.6      | 116.5      | 11290 | 6826  | 12260 | 10980 | 3974  | 0.37      | 27.88 | -67.76 | -56.72 | 8.75  | 8.22  |
| 104 | 50       | 850     | 250.2      | 111.7      | 10660 | 6689  | 10200 | 10520 | 3633  | 0.45      | 29.00 | -67.20 | -55.47 | 8.83  | 8.30  |
| 104 | 50       | 855     | 156.9      | 102.3      | 10490 | 6716  | 6553  | 8670  | 3710  | 0.65      | 30.11 | -66.61 | -54.22 | 8.92  | 8.39  |
| 104 | 50       | 900     | 205.3      | 116.9      | 11550 | 7080  | 10260 | 8990  | 3973  | 0.57      | 31.22 | -66.00 | -52.97 | 9.00  | 8.47  |
| 104 | 50       | 905     | 463.8      | 181.7      | 10860 | 9130  | 15370 | 13260 | 5374  | 0.39      | 32.32 | -65.38 | -51.72 | 9.08  | 8.55  |
| 104 | 50       | 910     | 422.3      | 161.4      | 12830 | 9420  | 13340 | 11540 | 5652  | 0.38      | 33.41 | -64.73 | -50.47 | 9.17  | 8.64  |
| 104 | 50       | 915     | 372.1      | 138.7      | 13870 | 8470  | 11470 | 9680  | 5566  | 0.37      | 34.50 | -64.07 | -49.22 | 9.25  | 8.72  |
| 104 | 50       | 920     | 142.7      | 98.5       | 10170 | 6926  | 5919  | 5784  | 5103  | 0.69      | 35.69 | -63.37 | -47.97 | 9.33  | 8.80  |
| 104 | 50       | 925     | 106.8      | 81.8       | 8070  | 5989  | 5341  | 4157  | 4514  | 0.77      | 36.67 | -62.66 | -46.72 | 9.42  | 8.89  |
| 104 | 50       | 930     | 130.4      | 87.3       | 8370  | 5737  | 5502  | 3852  | 4511  | 0.67      | 37.74 | -61.91 | -45.47 | 9.50  | 8.97  |
| 104 | 50       | 935     | 100.9      | 78.3       | 8230  | 5472  | 4895  | 3693  | 4197  | 0.78      | 38.80 | -61.14 | -44.22 | 9.58  | 9.05  |
| 104 | 50       | 940     | 105.3      | 80.1       | 7850  | 5090  | 8700  | 4329  | 4260  | 0.76      | 39.85 | -60.34 | -42.97 | 9.67  | 9.14  |
| 104 | 50       | 945     | 480.3      | 177.1      |       | 7560  | 17770 | 12380 | 5802  | 0.37      | 40.90 | -59.51 | -41.72 | 9.75  | 9.22  |
| 104 | 50       | 950     | 544.9      | 193.9      | 20650 | 10550 | 14930 | 14270 | 5971  | 0.36      | 41.94 | -58.64 | -40.47 | 9.83  | 9.30  |
| 104 | 50       | 955     | 191.8      | 134.7      | 14220 | 9420  | 10750 | 8880  | 5188  | 0.70      | 42.97 | -57.74 | -39.22 | 9.92  | 9.39  |
| 104 | 50       | 1000    | 629.2      | 168.4      | 16730 | 10060 | 16230 | 11710 | 6703  | 0.27      | 43.98 | -56.81 | -37.97 | 10.00 | 9.47  |
| 104 | 50       | 1005    | 389.6      | 147.6      | 14460 | 8970  | 14130 | 8660  | 6621  | 0.38      | 44.99 | -55.83 | -36.72 | 10.08 | 9.55  |
| 104 | 50       | 1010    | 402.2      | 141.7      | 14100 | 8230  | 13320 | 7890  | 6499  | 0.35      | 45.98 | -54.82 | -35.47 | 10.17 | 9.64  |
| 104 | 50       | 1015    | 463.6      | 163.9      | 15260 | 8640  | 15620 | 8470  | 7050  | 0.35      | 46.97 | -53.76 | -34.22 | 10.25 | 9.72  |
| 104 | 50       | 1020    | 734        | 215.9      |       | 10740 | 17740 | 11200 | 8390  | 0.29      | 47.93 | -52.65 | -32.97 | 10.33 | 9.80  |
| 104 | 50       | 1025    | 635.9      | 236.6      | 22970 | 11830 | 16500 | 12010 | 9080  | 0.37      | 48.89 | -51.50 | -31.72 | 10.42 | 9.89  |
| 104 | 50       | 1030    | 719        | 216.5      | 21230 | 12270 | 17400 | 10780 | 8810  | 0.30      | 49.83 | -50.29 | -30.47 | 10.50 | 9.97  |
| 104 | 50       | 1035    | 682.4      | 222.6      | 22660 | 12920 | 17280 | 10440 | 9220  | 0.33      | 50.75 | -49.03 | -29.22 | 10.58 | 10.05 |
| 104 | 50       | 1040    | 562.9      | 231.8      | 22930 | 12570 | 17070 | 10780 | 8250  | 0.64      | 51.85 | -47.72 | -27.97 | 10.67 | 10.14 |
| 104 | 50       | 1045    | 597.4      | 235.7      | 23250 | 12280 | 17410 | 12440 | 7420  | 0.39      | 52.54 | -46.34 | -26.72 | 10.75 | 10.22 |
| 104 | 50       | 1050    | 295.7      | 170.2      | 16900 | 9990  | 11890 | 10680 | 6362  | 0.58      | 53.40 | -44.90 | -25.47 | 10.83 | 10.30 |
| 104 | 50       | 1055    | 199.4      | 151.8      | 14360 | 9330  | 10070 | 8680  | 7110  | 0.76      | 54.24 | -43.40 | -24.22 | 10.92 | 10.39 |
| 104 | 50       | 1100    | 240.7      | 180.4      | 17080 | 9800  | 12650 | 7990  | 8010  | 0.75      | 55.06 | -41.83 | -22.97 | 11.00 | 10.47 |
| 104 | 50       | 1105    | 701        | 258.6      | 24900 | 12410 | 18000 | 10660 | 9690  | 0.37      | 55.86 | -40.19 | -21.72 | 11.08 | 10.55 |
| 104 | 50       | 1110    | 978        | 286.3      | 29150 | 15770 | 17850 | 12230 | 10910 | 0.29      | 56.62 | -38.47 | -20.47 | 11.17 | 10.64 |
| 104 | 50       | 1115    | 416.6      | 215.4      | 20940 | 13400 | 13290 | 8480  | 9320  | 0.52      | 57.36 | -36.68 | -19.22 | 11.25 | 10.72 |
| 104 | 50       | 1120    | 747        | 250.7      | 25960 | 13720 | 7860  | 10820 | 9910  | 0.34      | 58.07 | -34.81 | -17.97 | 11.33 | 10.80 |
| 104 | 50       | 1125    | 350.3      | 258        | 25240 | 13130 | 18300 | 9920  | 9630  | 0.74      | 58.74 | -32.86 | -16.72 | 11.42 | 10.89 |



## AVERAGE RAW DATA FROM STATION

|     | Date     | Time    | Global-R   | Diffuse-R  | Ho    | NE    | NW    | SE    | SW    | SC        | SAIt  | SAzm   | SHr    | Std   | Stime |
|-----|----------|---------|------------|------------|-------|-------|-------|-------|-------|-----------|-------|--------|--------|-------|-------|
|     | (Julian) | (clock) | (watt/sqm) | (watt/sqm) | (Lux) | (Lux) | (Lux) | (Lux) | (Lux) | sky ratio |       |        |        |       |       |
| 104 | 51       | 700     | 17.66      | 13.7       | 1252  | 941   | 849.2 | 930   |       | 0.78      | 3.78  | -77.07 | -82.95 | 7     | 6.47  |
| 104 | 51       | 705     | 26.74      | 19.63      |       | 1358  | 910   | 1378  |       | 0.73      | 4.96  | -76.73 | -81.7  | 7.08  | 6.55  |
| 104 | 51       | 710     | 34.88      | 25.52      | 2454  | 1376  | 1335  | 1030  |       | 0.73      | 6.14  | -76.39 | -80.45 | 7.17  | 6.64  |
| 104 | 51       | 715     | 44.52      | 31.75      | 3145  | 2169  | 1055  | 2320  |       | 0.71      | 7.31  | -76.04 | -79.2  | 7.25  | 6.72  |
| 104 | 51       | 720     | 50.78      | 37.87      | 3701  | 2680  | 2025  | 2746  |       | 0.75      | 8.48  | -75.68 | -77.95 | 7.33  | 6.8   |
| 104 | 51       | 725     | 59.42      | 43.64      | 4348  | 3173  | 2410  | 3256  |       | 0.73      | 9.65  | -75.32 | -76.7  | 7.42  | 6.89  |
| 104 | 51       | 730     | 66.6       | 49.2       | 4906  | 3740  | 2802  | 3666  |       | 0.74      | 10.82 | -74.95 | -75.45 | 7.5   | 6.97  |
| 104 | 51       | 735     | 75.4       | 55.15      | 5587  | 4447  | 3138  | 4196  |       | 0.73      | 11.99 | -74.56 | -74.2  | 7.58  | 7.05  |
| 104 | 51       | 740     | 88.3       | 62.32      | 6389  | 5379  | 3529  | 4857  |       | 0.71      | 13.15 | -74.18 | -72.95 | 7.67  | 7.14  |
| 104 | 51       | 745     | 126.4      | 73         | 7490  | 6838  | 4065  | 6362  |       | 0.58      | 14.32 | -73.78 | -71.7  | 7.75  | 7.22  |
| 104 | 51       | 750     | 139.5      | 81.2       | 8370  | 7990  | 4575  | 7410  |       | 0.58      | 15.47 | -73.37 | -70.45 | 7.83  | 7.3   |
| 104 | 51       | 755     | 175.9      | 95.1       | 9860  | 9750  | 5236  | 8940  |       | 0.54      | 16.63 | -72.95 | -69.2  | 7.92  | 7.39  |
| 104 | 51       | 800     | 226.1      | 107.6      | 10940 | 11100 | 5958  | 10040 |       | 0.48      | 17.79 | -72.52 | -67.95 | 8     | 7.47  |
| 104 | 51       | 805     | 192.4      | 113.9      | 11750 | 11650 | 6285  | 9190  |       | 0.59      | 18.94 | -72.09 | -66.7  | 8.08  | 7.55  |
| 104 | 51       | 810     | 178        | 121.7      | 12140 | 10580 | 6645  | 9420  |       | 0.68      | 20.09 | -71.64 | -65.45 | 8.17  | 7.64  |
| 104 | 51       | 815     | 200.9      | 129.9      | 13200 | 11500 | 7340  | 9040  |       | 0.65      | 21.23 | -71.17 | -64.2  | 8.25  | 7.72  |
| 104 | 51       | 820     | 329.6      | 124.9      | 13010 | 12450 | 7850  | 10080 |       | 0.38      | 22.38 | -70.7  | -62.95 | 8.33  | 7.8   |
| 104 | 51       | 825     | 242.7      | 122.7      | 13060 | 12670 | 7740  | 10340 |       | 0.51      | 23.52 | -70.21 | -61.7  | 8.42  | 7.89  |
| 104 | 51       | 830     | 308        | 123.4      | 12960 | 12210 | 7970  | 11130 |       | 0.40      | 24.65 | -69.71 | -60.45 | 8.5   | 7.97  |
| 104 | 51       | 835     | 374.5      | 129.5      | 13620 | 12730 | 8370  | 12010 |       | 0.35      | 25.79 | -69.19 | -59.2  | 8.58  | 8.05  |
| 104 | 51       | 840     | 402.8      | 136.6      | 14150 | 12730 | 9180  | 12440 |       | 0.34      | 26.91 | -68.66 | -57.95 | 8.67  | 8.14  |
| 104 | 51       | 845     | 400        | 151.1      | 15290 | 12740 | 10050 | 12750 |       | 0.38      | 28.04 | -68.11 | -56.7  | 8.75  | 8.22  |
| 104 | 51       | 850     | 235.2      | 158.2      | 15510 | 11730 | 10220 | 12910 |       | 0.67      | 29.16 | -67.55 | -55.45 | 8.83  | 8.3   |
| 104 | 51       | 855     | 538.8      | 194.2      | 16000 | 13800 | 10400 | 18070 |       | 0.36      | 30.27 | -66.96 | -54.2  | 8.92  | 8.39  |
| 104 | 51       | 900     | 584.4      | 210.5      | 20870 | 15510 | 10560 | 14410 |       | 0.36      | 31.38 | -66.36 | -52.95 | 9     | 8.47  |
| 104 | 51       | 905     | 501.3      | 200.8      | 20300 | 16720 | 10880 | 10530 |       | 0.40      | 32.49 | -65.74 | -51.7  | 9.08  | 8.55  |
| 104 | 51       | 910     | 266.4      | 155.5      | 15260 | 15070 | 10010 | 13880 |       | 0.58      | 33.59 | -65.1  | -50.45 | 9.17  | 8.64  |
| 104 | 51       | 915     | 311.2      | 162.1      | 13920 | 16390 | 10230 | 12500 |       | 0.52      | 34.68 | -64.43 | -49.2  | 9.25  | 8.72  |
| 104 | 51       | 920     | 160.3      | 126.1      | 13080 | 12960 | 10140 | 10750 |       | 0.79      | 35.77 | -63.74 | -47.95 | 9.33  | 8.8   |
| 104 | 51       | 925     | 198.1      | 134.4      | 12750 | 11640 | 10750 | 12980 |       | 0.68      | 36.85 | -63.02 | -46.7  | 9.42  | 8.89  |
| 104 | 51       | 930     | 230.9      | 159.8      | 16350 | 14840 | 10490 | 12820 |       | 0.69      | 37.92 | -62.28 | -45.45 | 9.5   | 8.97  |
| 104 | 51       | 935     | 320.1      | 153.6      | 15520 | 14060 | 10630 | 11960 |       | 0.48      | 38.99 | -61.51 | -44.2  | 9.58  | 9.05  |
| 104 | 51       | 940     | 181.5      | 139        | 14830 | 12230 | 10300 | 9970  |       | 0.77      | 40.05 | -60.72 | -42.95 | 9.67  | 9.14  |
| 104 | 51       | 945     | 196.5      | 134.5      | 13340 | 9970  | 10610 | 9620  |       | 0.68      | 41.1  | -59.89 | -41.7  | 9.75  | 9.22  |
| 104 | 51       | 950     | 290.5      | 155        | 15750 | 10670 | 10160 | 10920 |       | 0.53      | 42.14 | -59.02 | -40.45 | 9.83  | 9.3   |
| 104 | 51       | 955     | 248.3      | 161.3      | 15970 | 11330 | 10400 | 12550 |       | 0.65      | 43.17 | -58.13 | -39.2  | 9.92  | 9.39  |
| 104 | 51       | 1000    | 601.2      | 176.1      | 17740 | 13880 | 11080 | 16140 |       | 0.29      | 44.2  | -57.19 | -37.95 | 10    | 9.47  |
| 104 | 51       | 1005    | 258.5      | 172.9      | 17560 | 12910 | 10510 | 13400 |       | 0.67      | 45.21 | -56.22 | -36.7  | 10.08 | 9.55  |
| 104 | 51       | 1010    | 426.1      | 173.2      | 17310 | 12980 | 10500 | 13050 |       | 0.41      | 46.21 | -55.2  | -35.45 | 10.17 | 9.64  |
| 104 | 51       | 1015    | 489        | 181.8      | 18100 | 14250 | 9810  | 10100 |       | 0.37      | 47.19 | -54.14 | -34.2  | 10.25 | 9.72  |
| 104 | 51       | 1020    | 734        | 194.7      | 19930 | 15270 | 10460 | 19990 |       | 0.27      | 48.17 | -53.04 | -32.95 | 10.33 | 9.8   |
| 104 | 51       | 1025    | 642.4      | 181.7      |       | 14290 | 10740 | 19410 |       | 0.28      | 49.12 | -51.89 | -31.7  | 10.42 | 9.89  |
| 104 | 51       | 1030    | 565.5      | 192.1      |       | 13640 | 10620 |       |       | 0.34      | 50.07 | -50.68 | -30.45 | 10.5  | 9.97  |
| 104 | 51       | 1035    | 813        | 237.2      | 22910 | 15080 | 12750 | 20110 |       | 0.29      | 50.99 | -49.42 | -29.2  | 10.58 | 10.05 |
| 104 | 51       | 1040    | 837        | 230.9      | 22320 | 14450 | 13440 | 18800 |       | 0.28      | 51.9  | -48.1  | -27.95 | 10.67 | 10.14 |
| 104 | 51       | 1045    | 898        | 250.3      | 23610 | 14100 | 14080 | 19360 |       | 0.28      | 52.79 | -46.73 | -26.7  | 10.75 | 10.22 |
| 104 | 51       | 1050    | 924        | 259.4      | 25230 | 14500 | 15710 | 18050 |       | 0.28      | 53.66 | -45.29 | -25.45 | 10.83 | 10.3  |
| 104 | 51       | 1055    | 897        | 266.8      | 26640 | 15190 | 15920 | 18840 |       | 0.30      | 54.51 | -43.78 | -24.2  | 10.92 | 10.39 |
| 104 | 51       | 1100    | 935        | 271.8      | 27020 | 15530 | 16300 | 19610 |       | 0.29      | 55.34 | -42.2  | -22.95 | 11    | 10.47 |
| 104 | 51       | 1105    | 877        | 247.5      | 24030 | 15100 | 14810 | 21680 |       | 0.28      | 56.14 | -40.56 | -21.7  | 11.08 | 10.55 |
| 104 | 51       | 1110    | 617.3      | 240.8      | 22340 | 13220 | 14000 | 20410 |       | 0.39      | 56.91 | -38.83 | -20.45 | 11.17 | 10.64 |
| 104 | 51       | 1115    | 598.1      | 272.2      | 25450 | 15630 | 14540 | 20320 |       | 0.46      | 57.65 | -37.03 | -19.2  | 11.25 | 10.72 |
| 104 | 51       | 1120    | 925        | 295.6      | 29330 | 18190 | 15570 | 20660 |       | 0.32      | 58.37 | -35.15 | -17.95 | 11.33 | 10.8  |
| 104 | 51       | 1125    | 991        | 288.5      | 29210 |       | 16450 | 20890 |       | 0.29      | 59.04 | -33.19 | -16.7  | 11.42 | 10.89 |

## AVERAGE RAW DATA FROM STATION

|     | Date     | Time    | Global-R   | Diffuse-R  | Ho    | N     | S     | E     | W     | SC        | SAIt  | SAzm   | SHr    | Std   | Stime |
|-----|----------|---------|------------|------------|-------|-------|-------|-------|-------|-----------|-------|--------|--------|-------|-------|
|     | (Julian) | (clock) | (watt/sqm) | (watt/sqm) | (Lux) | (Lux) | (Lux) | (Lux) | (Lux) | sky ratio |       |        |        |       |       |
| 104 | 47       | 700     | 8.3        | 6.512      | 723   | 464.3 | 308.6 | 336.7 | 284.4 | 0.78      | 3.34  | -75.77 | -83.02 | 7.00  | 8.47  |
| 104 | 47       | 705     | 12.38      | 9.58       | 1071  | 670.4 | 508.9 | 507   | 445.9 | 0.77      | 4.51  | -75.44 | -81.77 | 7.08  | 6.55  |
| 104 | 47       | 710     | 20.82      | 15.75      | 1043  | 1012  | 896   | 891   | 825   | 0.76      | 5.68  | -75.09 | -80.52 | 7.17  | 6.63  |
| 104 | 47       | 715     | 29.52      | 21.91      | 2265  | 1355  | 1275  | 1222  | 880   | 0.74      | 6.85  | -74.74 | -79.27 | 7.25  | 6.72  |
| 104 | 47       | 720     | 37.82      | 27.49      | 2838  | 1694  | 1588  | 1316  | 1008  | 0.73      | 8.02  | -74.38 | -78.02 | 7.33  | 6.80  |
| 104 | 47       | 725     | 48.3       | 34.38      | 3533  | 2049  |       | 2182  | 1153  | 0.71      | 9.18  | -74.01 | -76.77 | 7.42  | 6.88  |
| 104 | 47       | 730     | 65.52      | 41.89      | 4188  | 2492  | 2506  | 2834  | 1394  | 0.64      | 10.34 | -73.64 | -75.52 | 7.50  | 6.97  |
| 104 | 47       | 735     | 81.2       | 50.31      | 4989  | 2909  | 3220  | 3478  | 1648  | 0.62      | 11.50 | -73.26 | -74.27 | 7.58  | 7.05  |
| 104 | 47       | 740     | 98.4       | 58.92      | 5766  | 3356  | 3919  | 4226  |       | 0.60      | 12.66 | -72.87 | -73.02 | 7.67  | 7.13  |
| 104 | 47       | 745     | 113.1      | 68.34      | 6508  | 3853  | 4756  | 4859  | 2048  | 0.59      | 13.81 | -72.46 | -71.77 | 7.75  | 7.22  |
| 104 | 47       | 750     | 128.1      | 72.1       | 7040  | 3984  | 5280  | 5166  | 2383  | 0.57      | 14.96 | -72.05 | -70.52 | 7.83  | 7.30  |
| 104 | 47       | 755     | 130.7      | 77.6       | 7830  | 4326  | 5355  | 5502  | 2533  | 0.59      | 16.11 | -71.63 | -69.27 | 7.92  | 7.38  |
| 104 | 47       | 800     | 139.9      | 85         | 8230  | 4534  | 5588  | 5798  | 2569  | 0.61      | 17.26 | -71.20 | -68.02 | 8.00  | 7.47  |
| 104 | 47       | 805     | 146.5      | 89.1       | 8680  | 4770  | 5854  | 6138  | 2630  | 0.61      | 18.40 | -70.76 | -66.77 | 8.08  | 7.55  |
| 104 | 47       | 810     | 160.1      | 92.6       | 9260  | 5122  | 6825  | 6884  | 2658  | 0.58      | 19.54 | -70.30 | -65.52 | 8.17  | 7.63  |
| 104 | 47       | 815     | 178.3      | 96.1       | 9820  | 5380  | 7590  | 7650  | 3006  | 0.55      | 20.68 | -69.83 | -64.27 | 8.26  | 7.72  |
| 104 | 47       | 820     | 193        | 99.3       | 10220 | 5645  | 8190  | 8110  | 3202  | 0.51      | 21.81 | -69.35 | -63.02 | 8.33  | 7.80  |
| 104 | 47       | 825     | 213.6      | 106.1      | 10960 | 6044  | 8920  | 8910  | 3440  | 0.50      | 22.94 | -68.86 | -61.77 | 8.42  | 7.88  |
| 104 | 47       | 830     | 227        | 112        | 11610 | 6315  | 9680  | 9400  | 3636  | 0.49      | 24.07 | -68.35 | -60.52 | 8.50  | 7.97  |
| 104 | 47       | 835     | 236        | 118.2      | 12160 | 6568  | 10100 | 9760  | 3793  | 0.50      | 25.19 | -67.83 | -59.27 | 8.58  | 8.05  |
| 104 | 47       | 840     | 264.9      | 126.3      | 12940 | 6969  | 10670 | 10370 | 3997  | 0.48      | 26.31 | -67.29 | -58.02 | 8.67  | 8.13  |
| 104 | 47       | 845     | 225.9      | 127.4      | 13230 | 7160  | 10250 | 10270 | 4139  | 0.56      | 27.42 | -66.73 | -56.77 | 8.75  | 8.22  |
| 104 | 47       | 850     | 234.4      | 128.3      | 13190 | 7390  | 9830  | 9940  | 4288  | 0.55      | 28.53 | -66.16 | -55.52 | 8.83  | 8.30  |
| 104 | 47       | 855     | 169.5      | 120.6      | 12480 | 7220  | 8880  | 8480  | 4243  | 0.71      | 29.63 | -65.57 | -54.27 | 8.92  | 8.38  |
| 104 | 47       | 900     | 187.3      | 125        | 11880 | 6983  | 9180  | 6909  | 4471  | 0.67      | 30.73 | -64.96 | -53.02 | 9.00  | 8.47  |
| 104 | 47       | 905     | 235.4      | 149.5      | 13790 | 7500  | 10680 | 9030  | 4626  | 0.64      | 31.82 | -64.32 | -51.77 | 9.08  | 8.55  |
| 104 | 47       | 910     | 350.9      | 195.2      | 18520 | 8910  | 13170 | 11420 | 5460  | 0.56      | 32.91 | -63.67 | -50.52 | 9.17  | 8.63  |
| 104 | 47       | 915     | 401        | 190.8      | 18080 | 9450  | 13580 | 12610 | 5633  | 0.48      | 33.99 | -63.00 | -49.27 | 9.25  | 8.72  |
| 104 | 47       | 920     | 343.3      | 195.8      | 20390 | 10100 | 14560 | 13880 | 5777  | 0.57      | 35.06 | -62.30 | -48.02 | 9.33  | 8.80  |
| 104 | 47       | 925     | 387.1      | 191.8      | 19990 | 10120 | 14120 | 13680 | 5897  | 0.50      | 36.13 | -61.57 | -46.77 | 9.42  | 8.88  |
| 104 | 47       | 930     | 324        | 192.6      | 20030 | 10150 | 15730 | 13670 | 5983  | 0.59      | 37.19 | -60.82 | -45.52 | 9.50  | 8.97  |
| 104 | 47       | 935     | 338        | 188.7      | 19640 | 10040 | 15130 | 13100 | 6020  | 0.56      | 38.24 | -60.05 | -44.27 | 9.58  | 9.05  |
| 104 | 47       | 940     | 411.4      | 214.5      | 21950 | 10690 | 15780 | 14230 | 6549  | 0.52      | 39.29 | -59.24 | -43.02 | 9.67  | 9.13  |
| 104 | 47       | 945     | 340.8      | 211        | 21740 | 11170 | 17300 | 14660 | 6543  | 0.62      | 40.32 | -58.40 | -41.77 | 9.75  | 9.22  |
| 104 | 47       | 950     | 502.9      | 229.8      | 24010 | 11680 | 20690 | 16520 | 7080  | 0.46      | 41.35 | -57.53 | -40.52 | 9.83  | 9.30  |
| 104 | 47       | 955     | 518.6      | 207.5      | 22470 | 11050 | 21090 | 16090 | 6905  | 0.40      | 42.36 | -56.62 | -39.27 | 9.92  | 9.38  |
| 104 | 47       | 1000    | 541.8      | 201.5      | 22060 | 10770 | 21630 | 15990 | 7010  | 0.37      | 43.37 | -55.68 | -38.02 | 10.00 | 9.47  |
| 104 | 47       | 1005    | 556.8      | 203.1      | 22500 | 10880 | 21840 | 16190 | 7040  | 0.36      | 44.36 | -54.70 | -36.77 | 10.08 | 9.55  |
| 104 | 47       | 1010    | 579.2      | 204        | 22570 | 11110 | 21640 | 15860 | 6986  | 0.35      | 45.34 | -53.68 | -35.52 | 10.17 | 9.63  |
| 104 | 47       | 1015    | 578.6      | 205.9      | 22600 | 11220 | 21250 | 15540 | 7100  | 0.36      | 46.31 | -52.62 | -34.27 | 10.25 | 9.72  |
| 104 | 47       | 1020    | 581.1      | 212.7      | 23300 | 11190 | 19590 | 15120 | 7090  | 0.37      | 47.26 | -51.51 | -33.02 | 10.33 | 9.80  |
| 104 | 47       | 1025    | 391.8      | 217.3      | 23130 | 11290 | 17840 | 14410 | 7190  | 0.55      | 48.20 | -50.36 | -31.77 | 10.42 | 9.88  |
| 104 | 47       | 1030    | 422.9      | 224.2      | 23360 | 12150 | 14920 | 13050 | 7480  | 0.53      | 49.12 | -49.15 | -30.52 | 10.50 | 9.97  |
| 104 | 47       | 1035    | 363.7      | 244.8      | 24830 | 12390 | 14190 | 12920 | 7760  | 0.67      | 50.03 | -47.90 | -29.27 | 10.58 | 10.05 |
| 104 | 47       | 1040    | 427.2      | 248.8      | 25890 | 13250 | 13860 | 13380 | 7560  | 0.58      | 50.92 | -46.58 | -28.02 | 10.67 | 10.13 |
| 104 | 47       | 1045    | 285.1      | 216.2      | 22630 | 12610 | 11250 | 11070 | 7180  | 0.76      | 51.78 | -45.21 | -26.77 | 10.75 | 10.22 |
| 104 | 47       | 1050    | 410.2      | 221        | 21760 | 11720 | 15190 | 10920 | 7860  | 0.54      | 52.63 | -43.79 | -25.52 | 10.83 | 10.30 |
| 104 | 47       | 1055    | 672.9      | 303        | 30930 | 15010 | 18340 | 15420 | 9720  | 0.45      | 53.46 | -42.29 | -24.27 | 10.92 | 10.38 |
| 104 | 47       | 1100    | 701        | 287.3      | 29700 | 15050 | 21470 | 15940 | 9930  | 0.41      | 54.26 | -40.74 | -23.02 | 11.00 | 10.47 |
| 104 | 47       | 1105    | 581.4      | 277.1      | 28260 | 14010 | 11590 | 13970 | 9300  | 0.48      | 55.04 | -39.11 | -21.77 | 11.08 | 10.55 |
| 104 | 47       | 1110    | 576.9      | 280.6      | 29000 | 13980 | 16640 | 12370 | 9560  | 0.49      | 55.78 | -37.42 | -20.52 | 11.17 | 10.63 |
| 104 | 47       | 1115    | 299.9      | 235.6      | 25370 | 13520 | 11550 | 10600 | 9040  | 0.79      | 56.50 | -35.66 | -19.27 | 11.25 | 10.72 |
| 104 | 47       | 1120    | 259.3      | 208.8      | 22400 | 13370 | 9440  | 10050 | 8300  | 0.81      | 57.19 | -33.82 | -18.02 | 11.33 | 10.80 |
| 104 | 47       | 1125    | 376.7      | 253        | 27330 | 13640 | 11690 | 12440 | 8160  | 0.67      | 57.85 | -31.91 | -16.77 | 11.42 | 10.88 |

## ประวัติผู้เขียน

นายทศพร นามเทพ เกิดเมื่อวันที่ 16 กุมภาพันธ์ 2510 เข้าศึกษาในระดับชั้นมัธยมศึกษาตอนต้น และมีมัธยมศึกษาตอนปลายที่โรงเรียนปรีณิธีรอนนทยาลัย เชียงใหม่ สำเร็จการศึกษาสถาปัตยกรรมศาสตร์บัณฑิต จากสถาบันเทคโนโลยีราชมงคล เมื่อปีการศึกษา 2536 (คะแนนเฉลี่ยสะสม 3.25) และเข้าศึกษาต่อหลักสูตรสถาปัตยกรรมศาสตรมหาบัณฑิต จุฬาลงกรณ์มหาวิทยาลัย ในภาควิชาสถาปัตยกรรมศาสตร์ สาขาวิชาเทคโนโลยีอาคาร ในปีการศึกษา 2541 และในปี 2538 ได้รับรางวัลชนะเลิศที่ 1 จากการประกวดออกแบบผลงานนักศึกษาในหัวข้อ "บ้านไทยร่วมสมัย" ของบริษัท สดาร์บดิ๊อค จำกัด



สถาบันวิทย์บริการ  
จุฬาลงกรณ์มหาวิทยาลัย